Idaho Department of Environmental Quality

Implementation Plan for the Cascade Reservoir Phase II Watershed Management Plan

Draft
June 16, 2000

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Introduction

This document represents the Implementation Plan for the Cascade Reservoir Phase I and Phase II Watershed Management Plans. It builds on those previous documents and utilizes the specific loading and reduction values identified in the Cascade Reservoir Phase II Watershed Management Plan which functions as the TMDL for Cascade Reservoir. This document outlines the basis for implementation of the phosphorus loading reductions called for in the Cascade Reservoir Phase II Watershed Management Plan and, while greater specificity as to source and reduction mechanisms has been provided herein, the original loading and reduction values have not been changed or revised. Within this document, a watershed-wide approach has been used to address implementation activities and changes in management practices associated with reduced discharge to Cascade Reservoir and its tributaries. This Implementation Plan has been compiled as a mechanism to identify and describe the specific pollutant controls and management measures to be undertaken, the mechanisms by which the selected measures will be put into action, and the individuals and entities responsible for implementation projects.

This Implementation Plan is not static. It is intended to be a dynamic, living document with implementation changes and modifications occurring as data and documentation become available, and implementation occurs throughout the life of the management plan.

Background

Cascade Reservoir is located in the Payette River Basin of southwestern Idaho in Valley County, one of the fastest growing counties in the state of Idaho. The Cascade Reservoir watershed encompasses approximately 357,000 acres in a moderately high elevation valley between West Mountain and the Salmon River Mountains. Major tributaries to the reservoir include the North Fork Payette River (NFPR), Mud Creek, Lake Fork Creek, Boulder Creek, Gold Fork River and Willow Creek, all of which discharge into the northern end of the reservoir. The overall watershed is divided into seven separate subwatersheds on the basis of drainage areas to these tributaries: North Fork Payette River, Mud Creek, Lake Fork, Boulder/Willow Creek, Gold Fork River, Cascade and West Mountain. A major portion of the watershed is steeply-sloped forested land, while the area immediately adjacent to the reservoir and major tributaries is predominantly gently-sloped agricultural land.

Surface Hydrology

The reservoir was created in the spring of 1949 with the completion of Cascade Dam, which was constructed across the North Fork Payette River, north-northwest of the present day location of the City of Cascade. The reservoir is 21 miles long, 4.5 miles wide at the widest point and is relatively shallow, measuring 26.5 feet in average depth. Cascade Reservoir, operated by the U.S. Bureau of Reclamation (USBR), provides irrigation, hydropower, flood control, recreation, and fish and wildlife habitat needs. Maximum storage capacity at completion was 703,200 acre-feet. Current storage capacity has decreased to an estimated 693,123 acre-feet due to sedimentation at the upper (northern) end of the reservoir.

Three major events, snow-melt, rain-on-snow and seasonal thunderstorms generate stream flow within the watershed. Snow-melt runoff is the predominant source used to fill the reservoir. Natural stream and irrigation channels convey snow-melt runoff to the reservoir and other water bodies in two major events, valley snow-melt (usually occurring in March and April) and mountain snow-melt (usually occurring in June and July) (USFS, 1998). During the irrigation season (May through October), a significant portion of the total tributary flow is diverted for irrigation of pastureland and fields. Sub-flood irrigation, in which large parallel ditches within a pasture are filled for an extended time period and the water allowed to saturate the soil separating the ditches, is the predominant irrigation practice within the watershed.

Water Quality Overview and Phase II TMDL Background

Cascade Reservoir has been identified as water quality limited under section 303(d) of the Clean Water Act (CWA). Water quality studies have shown that phosphorus is the pollutant of concern within the watershed. Monitored water quality data reveal that a significant phosphorus load is carried in the increased flows present during spring runoff. Summer irrigation practices also contribute to phosphorus loading in the reservoir. Nuisance algae growth resulting from nutrient loading has impaired the designated beneficial uses of the reservoir, specifically, fishing, swimming, boating and agricultural water supply. Internal recycling of sediment-bound phosphorus within the reservoir is also a concern.

Cascade Reservoir Water quality Concerns

Segment Identifier:	PNRS# 884, HUC 17050123
Pollutants of Concern:	Nutrients (Phosphorus), Dissolved Oxygen, pH
Uses Affected:	Fishing, Swimming, Boating, Agricultural Water Supply
Known Sources:	Point Sources – Municipal Wastewater Treatment Plant and Fish Hatchery Nonpoint Sources - Forestry, Agriculture, Urban/Suburban, Septic Systems, Internal Reservoir Recycling

In accordance with the section 303(d) requirements, a TMDL (total maximum daily load) was established for the Cascade Reservoir. The Phase I TMDL (or, Watershed Management Plan), which included an initial water quality assessment and nutrient reduction goal, was approved by EPA on May 13, 1996. Further evaluation of phosphorus reduction goals and alternatives was documented in the Phase II Watershed Management Plan, the second phase of the TMDL. The Phase II TMDL stated that a 37 percent overall load reduction in total phosphorus would bring the reservoir into compliance with water quality standards for phosphorus (0.025 mg/L in-lake total phosphorus concentration), chlorophyll a (10 µg/L in-reservoir chlorophyll a concentration), dissolved oxygen (concentrations exceeding 6 mg/L at all times, except for the bottom 20% of water depth where depths are 35 meters or less, and hypolimnion waters in stratified lakes and reservoirs), and pH (6.5 to 9.5 standard units). These targets were based on water quality models for Cascade Reservoir. Because of the direct relationship between algal growth, depleted dissolved oxygen and high total phosphorus concentrations within the water column, the reduction of total phosphorus input to the reservoir is being specifically targeted as a mechanism for overall water quality improvement. Estimated nonpoint source runoff accounts for a majority of the phosphorus input to Cascade Reservoir, averaging ~84 percent in an assessment of current and historical monitoring data. Estimated point source loading averages ~10 percent. Septic tank effluent accounts for the remaining ~6 percent of the total phosphorus load.

Table 1 shows estimated phosphorus loading and reduction goals for the Cascade Reservoir watershed from the Cascade Reservoir Phase II Watershed Management Plan (Phase II TMDL) which functions as the TMDL for Cascade Reservoir. As established in the Phase II TMDL document, estimated loads are broken down by major sources and by subwatershed. Loading for the Phase II TMDL document and this Implementation Plan is based on measured total phosphorus loads for water years 1993 to 1996.

Summary of Cascade Phase II TMDL Objectives

Water Quality Objective:	In-reservoir total phosphorus concentration of 0.025 mg/L In-reservoir chlorophyll a of 10 µg/L
Implementation Plan Objectives:	Sustained annual 37 percent reduction in total external phosphorus loadings
Component reductions:	
Point Sources:	7 percent reduction in the total phosphorus load (100% removal of municipal wastewater treatment plant effluent and reduced fish hatchery discharge)
Nonpoint Sources:	30 percent reduction in the total phosphorus load (Forestry, Agriculture, Urban/Suburban land use)
Operational Objectives:	Maintenance of a minimum Cascade Reservoir pool of 300,000 acre-feet.

Table 2 shows the yield coefficients, expressed as kg/acre/yr, established from monitoring and modeling data, as described in the Phase II TMDL and supporting source plans. These yield coefficients represent the basis of the implementation strategy for the Cascade Reservoir watershed as outlined in this document. These coefficients were used to establish a priority ranking for implementation on both a subwatershed and a land-use basis. The prioritization process is discussed in greater detail in following sections of the document.

Table 1. Annual Total Phosphorus Load (kg/yr) to Cascade Reservoir Averaged from 1993-1996 Instream Monitoring Data

Nonpoint Sources		Annual Phosphorus Load Allocated from Measured Load, kg/yr					Reduction Goal, kg/yr
		Natural Load and Background	Forestry	Agriculture	Urban	Total	
Subwsh	Cascade[1]	209	2	222	229	662	199
	Gold Fork	4,704	3,164	742	63	8,673	2,602
	Lake Fork	600	126	2,401	792	3,919	1,176
	Mud Creek	167	8	612	245	1,032	310
	North Fork[1]	3,445	739	6,994	1,342	12,520	3,756
	West Mtn.	984	924	391	83	2,382	715
	Boulder/ Willow	922	866	2,232	303	4,323	1,297
Septic[2]						2,205	840
Nonpoint Source Totals		11,031	5,829	13,594	3,057	35,716	10,895
Point Sources		**Annual Phosphorus Load Allocated from Measured Load, kg/yr**					**Reduction Goal, kg/yr**
						Total	
McCall Wastewater Treatment Plant						3,947	3,947
McCall IDFG Fish Hatchery						218	0
Point Source Totals						4,165	3,947
Grand Totals		11,031	5,829	13,594	3,057	39,881	14,842

[1] See *Identified Data Gaps* discussion in Section 2.3.3 of the Phase II TMDL, the discussion under the Implementation Priorities for Nonpoint Source Loads on page 12, and the discussion under the heading Agricultural Source Implementation Plan on page 26 of this document for more information.
[2] Septic system loads and load reductions were calculated separately from the 30% nonpoint source load reductions and are not allocated specifically to any subwatershed.

Table 2. Estimated Total Phosphorus Management Load per Acre (kg/acre/yr) for Major Nonpoint Sources by Subwatershed

Subwatershed	Total Phosphorus Yield Coefficient, kg/acre/yr					
	Forestry	Agriculture	Urban[2]	Management Load	Natural Load	Management plus Natural Load
Cascade	0.001	0.019	0.035	0.030	0.014	0.044
Gold Fork	0.012	0.036	0.029	0.031	0.054	0.085
Lake Fork	0.003	0.192	0.237	0.063	0.013	0.076
Mud Creek	0.036	0.045	0.094	0.063	0.016	0.079
North Fork (Total load)[1]	0.046	0.436	0.114	0.284	0.116	0.400
North Fork (Known source load)[1]	0.046	0.117	0.114	0.124	0.112	0.236
West Mtn.	0.028	0.035	0.013	0.047	0.034	0.0.81
Boulder/Willow	0.036	0.146	0.059	0.097	0.031	0.128
Watershed Average						0.031

[1] See *Identified Data Gaps* discussion in Section 2.3.3 of the Phase II TMDL, the discussion under the Implementation Priorities for Nonpoint Source Loads on page 12, and the discussion under the heading Agricultural Source Implementation Plan on page 26 of this document for more information.
[2] Does not include septic-based phosphorus loading.

Phosphorus Reduction Goals

In the Phase II TMDL, load capacity was divided among point source wasteload allocations (7 percent), nonpoint source load allocations (30 percent), and a margin of safety. In the North Fork Payette River (NFPR), the subwatershed load allocation reflects full (100 percent) removal of the City of McCall's Wastewater Treatment Plant discharge, changes in feeding management practices already in place for the Idaho Department of Fish and Game (IDFG) Fish Hatchery, and a 30 percent reduction of all nonpoint sources. A loading analysis for the Phase II TMDL demonstrated that for nonpoint sources, a 30 percent reduction of the total load (management load plus natural and/or background load) is possible from management sources alone. Management load is defined as that portion of the total load directly attributable to the impacts of human activities within the watershed.

Initially, the Phase II TMDL set a goal of reducing nonpoint source loads by 30 percent in each subwatershed. However, the Phase II TMDL acknowledged that "attainment of the 30 percent overall nonpoint-source reduction may be difficult in those subwatersheds (i.e. Gold Fork) where natural phosphorus loads represent the majority of the total load. It should be understood that a watershed-wide reduction of 30 percent of the nonpoint-source total phosphorus load (management load plus natural and/or background load) is required to reach water quality standards. It is recognized that efficient use of management efforts and available implementation monies should be of primary concern. Therefore, it is reasonable to expect that the 30 percent nonpoint source reduction goal may be reached by implementation measures resulting in greater than 30 percent in some subwatersheds to offset less than 30 percent reductions in others" (Phase II TMDL, page 12).

To achieve an overall reduction (management load plus natural and/or background load) of 30 percent for nonpoint sources within the watershed, a reduction of between 40 and 45 percent from management sources alone would be required. This 40 to 45 percent reduction is an average for the entire watershed. The actual percentage varies from subwatershed to subwatershed, and is dependant on the relative proportion of natural load in each subwatershed. It is not expected that the reduction in management load will be achievable at the same level of cost-effectiveness from all areas or sources within all subwatersheds. Therefore, (as above) it is reasonable to expect that the nonpoint source reduction goal will be reached by implementation measures resulting in greater than 40 to 45 percent reduction of management load in some subwatersheds to offset reductions of less than 40 to 45 percent of management load in others. The identification of specific implementation projects will be made with this consideration in mind.

Implementation Plan Overview

The purpose of this Implementation Plan is to outline the point and nonpoint source reduction measures that are needed to effect required water quality improvements and achieve Phase II TMDL goals within Cascade Reservoir. It is a living document and is expected to change as implementation occurs and more data becomes available.

This document was developed from source-specific implementation plans that were prepared by citizen-led source groups representing forestry, agriculture and urban/suburban interests. For each of the nonpoint sources, the following information is included in this Implementation Plan and the source-based implementation plans that were used as the basis for this document: the approach used to determine measures needed; best management practices (BMPs) needed to achieve phosphorus reductions; BMP efficiencies; and source-specific plans for assessing project effectiveness. The source-specific implementation plans also include monitoring programs and general schedules for implementation and monitoring actions. The Implementation Plan

describes an approach for tracking implementation plan progress, including a computer-based tracking system that has been designed to track projects and progress toward the 37 percent phosphorus reduction goal established for the Cascade Reservoir, outlines reasonable assurances associated with the different management measures, and discusses other options that may be considered if the preferred BMPs are insufficient.

Preparation of the individual source implementation plans and this integrated Implementation Plan was overseen by the Cascade Reservoir Coordinating Council (CRCC), which serves as the watershed advisory group for this TMDL process, and the Cascade Reservoir technical advisory committee (TAC). The CRCC includes nine local representatives appointed by the Idaho Department of Environmental Quality (DEQ) from all major sectors of the local community. CRCC members work directly with their respective interest groups to provide direction to DEQ in developing and implementing a watershed management plan, and help identify funding needs and sources of support for specific projects that may be implemented. The TAC is responsible for reviewing proposed projects to ensure they are consistent with phosphorus reduction goals, that they are scientifically sound and that monitoring follows scientifically accepted procedures. Source-specific work groups formed by the TAC were responsible for preparing the individual source implementation plans. The membership of the TAC includes scientific and engineering representatives from local, state and federal agencies, industry and municipalities.

Point Source Implementation Plan

There are two point sources of phosphorus loading to Cascade Reservoir, the McCall Wastewater Treatment Plant (WWTP) and the IDFG Fish Hatchery in McCall. Both sources discharge nutrients directly to the North Fork Payette River (NFPR) upstream of Cascade Reservoir operating under National Pollutant Discharge Elimination System (NPDES) permits.

The implementation of *point source* reduction measures has been identified as a primary priority within the Cascade Reservoir watershed as outlined by the Phase II TMDL process. Phosphorus reduction projects for each of the two existing point sources are currently underway. Because these reduction projects are already under construction (McCall WWTP / J-Ditch) or completed (IDFG Hatchery) at this time, these sources were not included in the overall prioritization effort for the watershed outlined below. Implementation priority for these projects has previously been identified as high, and recommended actions are being followed to completion.

McCall Wastewater Treatment Plant

The WWTP processes approximately 1.8 million gallons per day (MGD) at full capacity. The average load is roughly 0.7 MGD. Peak flows of 2.3 MGD have been reported however, due to infiltration of ground water and snow-melt. Infiltration is estimated to contribute as much as 1.6 MGD to the base flow. Peak inflow occurs during spring runoff and snow-melt periods and declines during the remainder of the year. Effluent phosphorus concentrations vary seasonally and typically exceed ambient concentrations in the NFPR. In treated wastewater effluent, the majority of the entrained phosphorus is present as dissolved ortho-phosphate, a readily bioavailable form of phosphorus. Proportionately, more than 85 percent of the total phosphorus in sewage effluent is in the form of dissolved ortho-phosphate, as compared to less than 1 percent in sediment associated phosphorus. Dissolved ortho-phosphate concentrations in treated effluent commonly range from 1.0 to 6.0 mg/l depending upon the level of wastewater treatment (Randall, Barnard and Stensel, 1992). Annual total phosphorus loading attributed to the treated effluent rose markedly from the early 1970's to 1988 due to increased population and recreational use. Since 1988, annual total phosphorus loading has remained relatively constant, ranging from 3,815 kg to 4,751 kg annually (An average load of 3,947 kg/yr is used in the Phase II TMDL document).

To address the required 100% reduction in discharge, a unique combination of agricultural and urban/suburban efforts has been undertaken by ranchers and farmers in the Mud Creek subwatershed and the City of McCall. This project, named after the J-Ditch irrigation canal it replaces, has allowed treated effluent from the City of McCall to be mixed with irrigation water and applied at agronomic rates to pasture and crop land in the Mud Creek drainage during the summer irrigation season. The current

phosphorous loading from the Mud Creek Subwatershed has been identified as predominantly the result of streambank destabilization, poor grazing practices and agricultural recharge from sub-flood irrigation practices (see Table 1). Detailed soil retention capacity and hydrological studies in this subwatershed have shown that with the conversion from sub-flood irrigation to sprinkle irrigation, and the subsequent reduction in ditching and sub-surface flow, the treated effluent applied at rates appropriate to the crop types grown will not result in breakthrough phosphorus loading to the reservoir or tributaries for (at minimum) 20 years (the current lifetime of the project). Additionally, the improvements made in water management, grazing management and streambank stabilization as a result of this project and associated others, will yield a substantial decrease in the existing phosphorus loading to the reservoir from this subwatershed. This project therefore, is projected to result in not only the removal of the WWTP effluent from the NFPR, but also a substantial reduction in nonpoint source loading to the reservoir from the Mud Creek subwatershed. Ground water wells are in place throughout the project area and will be monitored as necessary to determine ground water response to the sub-flood to sprinkler conversion and any trends in phosphorus content of the sub-surface waters.

The J-Ditch project represents a major step in the eventual, 100 percent removal of the Wastewater Treatment Plant effluent from the NFPR identified by the Phase II TMDL document. Additional effluent generated during non-irrigation months will be retained in storage lagoons currently under construction by the City of McCall. Effluent stored over the winter months will be land applied the following irrigation season. Farmers and ranchers participating in this project were originally using sub-flood irrigation practices. To date, all participants have installed on-farm sprinkler systems to be able to utilize the mixed effluent. Currently, the system is able to remove all the treated effluent from the NFPR during the irrigation season. Work on the winter storage lagoons is on-going. Total (100 percent) removal of the treated effluent from the NFPR will be possible with the completion of winter storage lagoons by the City of McCall (scheduled for November 2000). According to the Phase II TMDL document, the McCall Wastewater Treatment Plant is required to have a reduction goal of 3,947 kg/yr or 100 percent reduction of the phosphorus load to the Cascade Reservoir. Completion of this project will fulfill that reduction goal.

Idaho Fish and Game Fish Hatchery

The IDFG Fish Hatchery requires flowing water for maintenance and growth of Chinook Salmon stock and discharges 12.9 MGD to the NFPR. In 1994, the fish food being used (1.7 percent phosphorus by weight) was replaced by a food type with lower phosphorus content (0.7 percent phosphorus by weight). This substitution was further augmented by changes in feeding practices. The combination of these changes has resulted in a substantially reduced phosphorus load since 1994. Pre-1994 total phosphorus loads were evaluated at 726 kg/yr (average). Post-1994 loads have been evaluated at 218 kg/yr (average). Current contributions represent an overall 70%

reduction in the pre-1994 hatchery-related load. The reduced load accounts for less than 1 percent of the total phosphorus load to the Cascade Reservoir. The Phase II TMDL document provided the Fish Hatchery with a wasteload allocation of 218 kg/yr, and did not seek any further reductions.

Routine monitoring of hatchery effluent is ongoing as a requirement of the permit process. The data generated will be used to identify trends in the overall phosphorus loading and to further refine operations and management to greater efficiency in phosphorus reduction.

Implementation Priorities for Nonpoint Source Loads

As stated in the preceding section, the implementation priority of *point source* reduction measures has previously been identified as high, and phosphorus reduction projects identified for each of the two existing point sources are already under construction (McCall WWTP / J-Ditch) or completed (IDFG Hatchery) at this time. Therefore, these sources were not included in the overall nonpoint source prioritization effort for the watershed outlined below.

Implementation of reduction measures for *nonpoint source* inputs within the watershed has been prioritized on a subwatershed basis in an effort to increase the efficiency of implementation efforts in both a cost and a water-quality benefit fashion. It is expected that this ranking will be re-assessed periodically as new data becomes available, and as implementation proceeds. In this manner, priority status can be consistently assigned to those areas representing the greatest concern and the greatest cost-efficiency for total phosphorus reduction.

Current subwatershed priority rank designations have been assigned through the evaluation of several criteria including: total phosphorus yield coefficients (as outlined in Table 2), proximity and delivery efficiency on a source-specific basis, and data available within a subwatershed to target specific treatment areas and mechanisms. The relative proportion of management load to total load (i.e. cost efficiency considerations and cost-benefit analyses), previous load reduction efforts, and development status of the subwatershed were also considered, as was the amount of phosphorus reduction implementation already accomplished within each subwatershed. These factors represent the primary mechanism for priority rank assignment of subwatersheds.

The North Fork Payette River (NFPR) subwatershed was not ranked initially due to the lack of information identifying specific phosphorus sources within this subwatershed. Instream monitoring data has quantified the total phosphorus loading to the reservoir from this subwatershed, however, the nonpoint source-specific assessment of delivered loading does not account for the total monitored phosphorus load. Specific details on the mechanism for assessment of NFPR loading are included in the *Agricultural Source Implementation Plan* section of this document. To fill this data gap, additional monitoring is being conducted to allow better quantification of sources and assignment of the monitored load. Aerial assessment has also been undertaken to identify specific areas within the subwatershed and river channel that need more in-depth evaluation. All data and information collected will be used to determine loading sources, priority ranking and necessary phosphorus reduction locations/sources within the subwatershed by or before 2003 when the Phase II TMDL results and accomplishments are reviewed. At this time, all subwatershed priority rankings will be re-evaluated for applicability and appropriateness in reaching the reduction goals. NFPR will be included in the subwatershed priority ranking following this assessment.

Starting with the total phosphorus yield coefficient data for management-based loading (as shown in Table 2), an initial priority ranking was performed. Using this ranking, further consideration was then given to the primary form of phosphorus in the delivered load and the transport or delivery efficiency. Higher priority was given to subwatersheds that showed a greater proportion of bioavailable phosphorus load and to those that had high transport efficiencies. Because the input of bioavailable phosphorus to the reservoir results in rapid and excessive algae growth, it was reasoned that targeting subwatersheds where a substantial proportion of the phosphorus being delivered was bioavailable would result in a more marked improvement in water quality over a shorter time span than simply targeting phosphorus loads on a total mass basis alone. The potential for rapid, highly efficient delivery of these loads represented an additional priority.

As stated above, the relative proportion of management load to the total load delivered by a subwatershed was evaluated as a priority ranking mechanism for nonpoint sources. This information was also utilized as a cost-efficiency assessment mechanism to ensure that the projects funded and implemented were the most cost-effective for the reductions achieved. For some subwatersheds, reductions may be much more expensive due to the higher proportion of natural loading from these areas.

Since it is recognized that new development often results in a land-use change and represents the potential to introduce additional loading from construction impacts, subwatersheds exhibiting substantial new growth were given some priority consideration as well. As outlined in the sections of this document specific to urban/suburban implementation and land-use changes, the cost of requiring new construction to meet designated load criteria is significantly lower than that of retrofitting existing development. Therefore, the establishment of policy, resolutions and ordinances addressing the water-quality impacts will be given priority status within the watershed. When the appropriate policies, resolutions and ordinances are in place for new development, priority will then be given to addressing existing development sources.

Based on total phosphorus yield coefficients alone, the West Mountain subwatershed received a priority ranking of number four. This ranking was increased to number two due to consideration of the fact that failing septic systems within this subwatershed represent a significant threat to water quality because of their substantial bioavailable phosphorus load (>85% of the total phosphorus load) and their near-shoreline locations. A majority of these aged systems are located in direct proximity to the southwestern shoreline of Cascade Reservoir. This area of the reservoir is very susceptible to water quality impacts from bioavailable phosphorus loading due to shallow depth and slow to stagnant water movement in the late summer season. Algae growth in this section of the reservoir is often moved to other areas along the eastern

shoreline through wind and wave action, thus creating further degradation of water quality over a larger area.

Based on total phosphorus yield coefficients alone, the Mud Creek subwatershed received a priority ranking of number three. However, the priority status was reduced to number five due to the fact that the yield coefficients used were calculated from data collected during the 1993 to 1996 water years. Since these data were collected, a significant amount of the sub-flood irrigation (known to be a significant phosphorus transport source) in this subwatershed has been replaced with sprinkler irrigation through implementation of the J-Ditch project (outlined on p. 9). Impacts of this project on the total phosphorus yield coefficient for this subwatershed are not yet known, but are expected to result in significant phosphorus reductions due to decreased subsurface recharge, decreased incidence of anoxic soils and decreased erosion and sediment transport potential. In similar system conversion projects in other areas, two to four years have been necessary for the hydrology of the system to stabilize sufficiently to collect accurate trend data for evaluation. Data will continue to be collected from this subwatershed. When a stable trend is identified, the priority ranking will be re-assessed based on the new information.

Given the above considerations, the subwatersheds were ranked in order of priority (highest to lowest) as follows:

1. Boulder/Willow
2. West Mountain
3. Lake Fork
4. Gold Fork
5. Mud Creek
6. Cascade

North Fork Payette River - Not currently ranked

It should be noted that as more information is collected and program efficiencies are identified in a more accurate fashion, the preliminary ranking of subwatersheds above may be re-evaluated prior to the established assessment scheduled for 2003 as part of the TMDL process.

Project-specific priority ranking within a designated subwatershed has been identified according to the existing procedures identified for forestry, agricultural and urban/suburban sources as outlined in general fashion in the following sections. More detailed discussions of project-specific priority rankings are available in the later sections of this document and the source-specific implementation plans.

The Forestry Source Implementation Plan assigned highest priority status to road-based sediment/phosphorus reduction projects and improved grazing management. The Forestry Source Implementation Plan determines priority road segments based on the

mass of delivered load and most immediate delivery pathways. Thus logging roads contributing substantial erosion-based sediment loads that show rapid delivery pathways to a water body have been designated highest priority for implementation of best management practices (BMPs). Grazing management plans (overseen by Idaho Department of Lands (IDL), Boise Cascade Corporation (BCC) and the US Forest Service (USFS)) will also be upgraded in a high priority fashion to improve grazing management practices as current grazing agreements expire and new permits are established. In correlation with the subwatershed rankings above, logging roads identified as contributing substantial erosion-based sediment loads with rapid delivery pathways to a water body within the Boulder/Willow subwatershed will be given the highest priority consideration, followed by similar roadways in the West Mountain and Lake Fork subwatersheds respectively. Specific roadway and grazing management BMPs to be implemented are identified and discussed in greater detail in the *Forestry Source Implementation Plan* section of this document and the Forestry Source Implementation Plan (Appendix A).

The Agriculture Source Implementation Plan determines the priority of project implementation based on distance from a water body and condition of assessed riparian areas. The designated tier system (riparian, irrigated lands, and non-irrigated uplands) assigns highest priority to implementation in degraded riparian areas and improved functioning capacity. It is recognized that improvements in riparian areas will also serve to reduce inputs from upland management. In correlation with the subwatershed rankings above, Tier 1 lands within the Boulder/Willow subwatershed will be given the highest priority consideration, followed by Tier 1 lands in the West Mountain and Lake Fork subwatersheds respectively. Specific BMPs to be implemented are identified and discussed in greater detail in the *Agricultural Source Implementation Plan* section of this document and the Agricultural Source Implementation Plan (Appendix B).

The Urban/Suburban Source Implementation Plan has assigned highest priority status to roadway upgrades and stormwater improvements. The Urban/Suburban Source Implementation Plan prioritizes road upgrades based on proximity to water systems where delivery to the reservoir is most efficient. Prioritization for stormwater and septic inputs initially targets those systems in the most degraded condition, with secondary priority given to upgrading those systems currently functioning at a higher level. In correlation with the subwatershed rankings above, stormwater improvements within the Boulder/Willow subwatershed (City of Donnelly and rural subdivisions) will be given the highest priority consideration, followed by stormwater improvements in the West Mountain (rural subdivisions) and Lake Fork (community of Lake Fork and rural subdivisions) subwatersheds respectively. Specific BMPs to be implemented are identified and discussed in greater detail in the *Urban/Suburban Source Implementation Plan* section of this document and in the Urban/Suburban Source Implementation Plan (Appendix C).

The prioritization of septic-based load reductions within the watershed is well established. Septic to sewer conversions within Boulder/Willow subwatershed have been given the highest priority consideration and an approved facility is now in place. Homeowners not currently hooked up to the sewer system are being actively encouraged to do so. Efforts for septic to sewer conversion within the West Mountain subwatershed are now of highest priority. When an approved sewer system is established for residents of this subwatershed, priority will be given to those systems within the Lake Fork subwatershed that represent a direct transport potential. These projects are discussed in greater detail in the *Urban/Suburban Source Implementation Plan* section of this document and the Urban/Suburban Source Implementation Plan (Appendix C).

With the subwatershed priority ranking discussed above, identification of projects and funding has been initiated in an aggressive fashion for Boulder/Willow, West Mountain and Lake Fork subwatersheds. Starting in March of 1999, federal 319 Grant monies have been pursued and approved for both the Boulder/Willow and West Mountain subwatersheds. An Environmental Quality Incentive Program (EQIP) priority area has been established for the Lake Fork subwatershed. Further funding and project identification is currently in process.

It is recognized that funding for the total implementation of a watershed scale project is not a strong probability at this time. Funding identification will therefore proceed on a priority basis at the most expansive level possible. Data generated by modeling efforts specific to Cascade Reservoir have indicated that attainment of water quality standards within the reservoir will require full achievement of the 37 percent reduction target. Delays in funding to attain this total reduction will result in delays in the attainment of full beneficial use support within the reservoir. Such delays will be minimized to the extent possible by an aggressive approach to funding identification and procurement as outlined below.

To date, 319 Grant funds have been the primary source of support for the implementation effort. While this program will continue to be utilized to the extent possible, it is recognized that it cannot act as the sole sponsor for implementation efforts. Therefore, to the degree possible, a comprehensive list of applicable Federal, State, Local and Private funding sources has been compiled that includes funding status, applicable projects, and funding/distribution schedules. This listing functions as the basis for grant and cost-share funding for the implementation effort. In addition, special legislative disbursements are being discussed with the appropriate political entities, and an ongoing discussion has been initiated with appropriate agency representatives to allow future programs to be designed with implementation funding in mind. Joint efforts are currently underway to pool several smaller monetary sources to create a total budget sufficient to fund proposed site-specific implementation measures. Examples of such cooperative efforts are: an urban/suburban stormwater proposal to use a refurbished irrigation ditch to funnel and collect stormwater so it can be

effectively treated prior to discharge into surface water, and the joint application for federal transportation and 319 Grant dollars to improve roadways on forest, agricultural and subdivision lands to reduce erosion and improve drainage capabilities. Both of these projects are in the initial phases of development and are expected to act as models for future efforts. This funding identification program is dynamic in nature and will change and expand as additional sources become available.

Funding sources for the top three subwatersheds Boulder/Willow, West Mountain and Lake Fork will continue to be actively sought and requested through all available channels. Program and funding identification for the remaining subwatersheds will proceed following the acquisition of funding for the priority subwatersheds as outlined above. Re-assessment of the current priority ranking, followed by program and funding identification for the North Fork Payette River subwatershed, will proceed as soon as adequate data is available to determine appropriate targets for management practices. Monitoring will continue in the Mud Creek subwatershed to determine trend stabilization from the implementation of the J-Ditch project.

It should be noted that while the preceding subwatershed list represents a general priority schedule for the watershed, certain projects within subwatersheds designated as lower priority *will* be implemented if funding becomes available and a positive impact is recognized for the proposed projects. Priority will be given to projects identified within high priority subwatersheds, but no project that demonstrates a positive impact and has identified funding will be denied for the *sole* reason that it targets areas in a lower priority subwatershed.

Nonpoint Source Implementation Plans

Nonpoint sources of phosphorus loading to Cascade Reservoir are grouped into three major categories based on land use: forestry, agriculture, and urban/suburban. The following sections address the implementation plans and phosphorus reduction measures for each of these nonpoint sources.

Forestry Source Implementation Plan

Forestry land use totals 184,092 acres within the Cascade Reservoir watershed, representing roughly 70 percent of the total land area. Evaluations and analyses conducted previously as part of the Cascade Reservoir Phase II TMDL development indicate that road erosion and grazing management are the primary sources of phosphorus delivered to Cascade Reservoir from forest management lands. Instream monitoring data from 1993-1996 indicate that approximately 15 percent of the total phosphorus (5,829 kg/yr) delivered to Cascade watershed streams was derived from forest lands. Of this, 1.15% is estimated to be bioavailable. A majority of the management-related phosphorus load is bound to sediment delivered from forest roads. The Gold Fork River subwatershed, where the majority of the forest lands lie, delivers an estimated 77 percent of this sediment.

The Forestry Source Group considers that the most effective means for controlling the generation of nonpoint source pollution is by applying preventative and restorative watershed management practices. Nonpoint source pollution control is accomplished through the application of technology based BMPs. Using an iterative approach to management and the control of nonpoint sources of pollution, the forestry stakeholders will: apply a BMP, monitor, evaluate, adapt and determine if the practices are effectively reducing sediment delivery to streams.

A 40 to 45 percent overall reduction in man-induced forestry load (2,652 kg total phosphorus per year) is needed to achieve the 30 percent reduction in total phosphorus load across the Cascade Reservoir watershed. This 40 to 45 percent reduction is an average for the entire watershed. The actual percentage varies from subwatershed to subwatershed, and is dependant on the relative proportion of natural load in each subwatershed. In addition, the natural range of variability across watersheds and over time is high in the Cascade Reservoir watershed. Because of the steep slopes associated with forested lands in the majority of the watershed, natural sediment and phosphorus loading account for a significant fraction of the total phosphorus load delivered from forested land. This is especially evident in the Gold Fork subwatershed where phosphorus loading from natural processes represents 54 percent of the total phosphorus load, the greatest relative percentage of any subwatershed within the scope of this plan. This load it attributed to naturally high sediment load from granitic soils and landslides. The *Forestry Implementation Plan: Cascade Reservoir Watershed*

Phase II Management Plan, provides a more detailed description of the proposed approach for achieving phosphorus reductions from forestry nonpoint sources.

Approach to Determining Implementation Measures

Total phosphorus yield coefficients expressed as kg/acre/yr (Table 2) were used to calculate nonpoint source loads in each subwatershed. These yield coefficients were estimated from monitoring data, as described in the Phase II TMDL and supporting source plans, and were used as a basis for establishing a subwatershed-based priority ranking for implementation (as described in the preceding sections). These coefficients, on a management or practice-specific basis, have been used to establish a priority ranking within the nonpoint source-based loading for each subwatershed. Through this prioritization process, the total phosphorus load from forest roads and forest grazing allotments have been identified as the highest priorities for implementation of reduction measures within the Forestry Source Implementation Plan.

Phosphorus reductions for forestry management practices have been calculated using the formulas and BMP efficiencies described in the Phase II TMDL and associated reference documents. The majority of forest BMPs address sediment production and are intended to either keep sediment from being produced, or divert sediment onto the forest floor and away from streams. The effectiveness of the approved BMPs in relation to phosphorus as a nonpoint source has not been well established through monitoring. The effects of forest management on sediment delivery and the effectiveness of BMPs to reduce sediment from forestry operations, however, have been well studied. (Please see the *Forestry Source Implementation Plan: Cascade Reservoir Watershed Phase II Management Plan* for further discussion.)

The natural variability of forest and range lands, and the limited time and funds available to measure actual concentrations of phosphorus for each watershed, lead to the alternative of using a properly verified and calibrated model for estimating pollutant reductions. SEDMODEL was selected as the modeling tool to estimate sediment load from roads as a surrogate for phosphorus load. The components of SEDMODL have been individually validated through research efforts to determine erosion rates or the effectiveness of BMPs. However, the precision and reliability of the combination of these components has not been tested. The SEDMODEL results have been used, along with other data and information, to help make decisions by comparing relative percent phosphorus reduction from treatments. The Forestry Source Group will continue to use the model results to make treatment decisions, taking the precision and accuracy of estimated values into consideration.

Regulations Governing the Application of Forestry BMPs

BMPs for forest management activities are mandated for all private, state, and federal forest practices in Idaho. The following sections summarize the mandated practices affecting sediment and phosphorus inputs into water bodies.

All Land Ownerships

Forest management activities on all forested lands within the State of Idaho are required to follow the Rules and Regulations pertaining to the Idaho Forest Practices Act (IFPA), Title 38, Chapter 13, Idaho Code (IDAPA 20.15). Within these rules, practices shall also be in compliance with the Stream Protection Act, Idaho Water Quality Standards and Waste Water Treatment Requirements, the Idaho Pesticide Law, and the Hazardous Waste Management Act of 1983. Forest Practices Rules apply to private and state forested lands. Federal lands follow Forest Practices Act as described in forest plans.

Federal Lands

The Inland Native Fish Strategy (INFISH 1995) is intended to provide interim direction on *Federal lands* to protect habitat and populations of resident native fish outside of anadromous fish habitats in Idaho and other Pacific Northwest states. This direction is in the form of riparian management objectives, standards and guidelines, and monitoring requirements.

Road Sediment Runoff

The construction and use of roadways represent the major source of sediment from timber harvest activities, with erosion and landslides caused by management activities representing more minor sources. The current estimate of total phosphorus loads to Cascade Reservoir from roads on forested lands is 2,366 kg/yr. This estimate comes from a combination of in-depth, site-specific watershed analysis conducted in the Gold Fork subwatershed in 1996, as well as the application of a road sediment delivery model, SEDMODL Version 1.0, developed by Boise Cascade to determine the magnitude of road sediment runoff in all other subwatersheds. The model uses the same calculations that were used in the Gold Fork subwatershed analysis. Information on precipitation rates, underlying geology and basic erosion rates is also used. Sediment runoff is converted to phosphorus quantities based on the soil monitoring study values conducted in support of this effort. (See the *Cascade Reservoir Watershed Management Plan Phase II TMDL* and the *Forestry Source Plan for Cascade Reservoir Watershed Management Plan Phase II TMDL*, Supporting Information, for information on the soil monitoring study.)

In recent years, the SEDMODL model has been updated. This document and Table 3 reflect the most current and accurate estimates of phosphorus loading for forest roads. It should be kept in mind that there are other important sources of phosphorus in forested areas. Landslides, sheet erosion off previously harvested forest areas and the off-road recreational uses of forested lands also contribute to phosphorus loading in Cascade Reservoir. These sources are not addressed in Table 3, below, but are considered in the overall analysis.

Table 3. Estimated Total Phosphorus Loading from Forest Roads

Subwatershed	Sediment, tons/year	Total Phosphorus, kg/year	Bioavailable Phosphorus, kg/year
West Mountain	1,693	266	3.1
NF Payette	571	90	1.0
Cascade	138	22	0.3
Lake Fork	69	11	.13
Boulder-Willow	1,010	159	1.8
Gold Fork	11,563	1,818	21.0
Total	15,044	2,366	26.5

Proposed Implementation Measures: Road Improvements

The Forestry Implementation Plan Source Group used the data from Gold Fork drainage and the sediment model to identify priority roads for treatment to stabilize and reduce sediment erosion. Roads with high estimated sediment inputs (>50 tons/year) have highest priority for management. Treatments target at least an 80 percent reduction in sediment coming from each treated segment. Where 80 percent cannot be achieved, the actual reduction attained is estimated. Roads will NOT be treated on an "entire road length basis". Roadways will be evaluated for sediment delivery and erosion potential as separate road segments. These segments will then be prioritized for improvement implementation. Priority segments will be treated, as funding becomes available, until the phosphorus reduction goals are met.

Activities to be conducted with the purpose of reducing phosphorus loads to Cascade Reservoir include extensive road upgrades (including graveling and paving, adding culverts), slash management practices, closing and/or relocating roads, and making other improvements.

These practices will be applied to roads within the Cascade Reservoir watershed until load reduction goals have been met at which point the forestry landowners will continue to treat and maintain roads using the standard procedures for identifying and

funding projects. Road maintenance is scheduled on an annual basis and includes blading, shaping, spot graveling, and installation and cleaning of drainage structures (waterbars, culverts, driveable dips, etc).

Table 4 describes some of the highest priority road improvement projects for the Cascade Reservoir watershed. Other areas for future road improvement projects include: South Fork Gold Fork; Mud Creek; Big Sage and Van Wyck Campground; French Creek (in Gold Fork); Louie Creek; Willow Creek; Powelson Creek; Jug Creek; Poor Man Creek; Kennally Creek; and Hartzell Creek.

Table 4. Summary of Some High Priority Forest Road Projects

Subwatershed	Location	Miles of Roads to Be Treated	Recommended Treatment	Estimated P Reduction (kg/yr)
Gold Fork	T17NR4ES16	2.8	Outslope and drainage upgrade	0.2
Boulder/Willow	T17NR4ES9	4.3	Outslope, drainage fixes, short gravel segment	5.3
Boulder/Willow	T18NR4ES29	4.9	Gravel and drainage	12.7
Boulder/Willow	T18NR4ES31	0.9	Drainage upgrade	2.7
Boulder/Willow	T17NR3ES36	0.2	Gravel	0.6
Gold Fork	T16NR4ES30	8.4	Gravel	151.8
Gold Fork	T16NR5ES28	13.9	Gravel (drainage)	71.3
Gold Fork	T15NR4ES16	2.2	Move road, decommission road, gravel	44.2
West Mountain	T16NR3ES29	2.1	Gravel, drainage	10.3
NF Payette	T18NR2ES29	1.1	Gravel	13.0
NF Payette	T18NR2ES34	0.7	Gravel	4.3
NF Payette/West MT	T17NR2ES23	1.4	Gravel	3.9
Gold Fork	T16NR5ES31	1.9	Gravel	29.2
West Mountain	T14NR3ES19	5.5	Gravel	149.7
Gold Fork	T15NR5ES6	0.0	Stream bank stabilization	230.4
Gold Fork	T15NR4ES29	0.4	Gravel	4.6
Total Estimated Reductions				734.0

Given the proposed projects outlined in Table 4 above, and the road segments identified for improvement, the total phosphorus reduction projected from road-based projects is 1,454 kg/yr.

Forest Service. The Boise and Payette National Forest will treat roads primarily on a project-by-project basis. For each project, the model will be validated and appropriate treatment measures implemented. These activities will be initiated as funds from an annual budget allocation are made available.

Idaho Department of Lands. IDL has recently completed a road inventory on their lands within the Cascade Reservoir drainage to help identify problems needing attention and to create an accurate inventory of roads. IDL will continue to conduct

routine road inspections and provide road maintenance and improvements to reduce erosion and sediment delivery to streams. Periodic maintenance and improvements will be accomplished as the need is identified or in conjunction with scheduled timber sales.

Boise Cascade Corporation. Boise Cascade annually budgets funds for road maintenance and improvements. Improvements in Cascade Reservoir drainage area will be given high priority until the reduction goals are met. Maintenance and improvement of other Boise Cascade roads will, however, be necessary and can affect the improvement schedule in the Cascade Reservoir watershed.

Grazing on Forest Lands

The Phase II TMDL estimates that grazing occurs on a total of 42,984 acres of forested lands in the Cascade Reservoir watershed. Impacts from grazing practices on forested lands include increased sediment and nutrient loading due to waste deposition and erosion of stream bank areas destabilized by animal impacts and waste deposition. Phosphorus inputs from grazing were estimated using the methods described in the Agricultural Source Plan (Phase II TMDL) and the Agricultural Implementation Plan. Of the forested lands grazed, 6 percent (2,601 acres) are in Tier 1 (the area along streams with a 150 foot buffer on both sides) and 94 percent (40,383 acres) are in Tier 3 (which includes grazed pastureland or upland that is not irrigated). The total phosphorus load estimated for forest lands from grazing is 2,565 kg/yr.

A phosphorus loading reduction of 1,189 kg/yr is sought to achieve the needed reduction for grazed forest lands. To meet phosphorus reduction goal, the priority will be to manage grazing on forested lands to have a Tier 1 effectiveness of 90 percent and a Tier 3 effectiveness of 40 percent.

Proposed Implementation Measures: Grazing Management

Most of the state and private forest lands and a small portion of the federal forest lands are grazed by cattle. Sheep are also grazed on the West Mountain, North Fork, Lake Fork Creek, Boulder Creek, Cascade and Gold Fork River subwatersheds. Grazing on forested lands is generally managed through leases, through which the landowner allows access to the lands by livestock operators and their animals. It has become common practice to develop grazing management plans with the lessees to minimize the environmental damage caused by grazing. There are several approaches that can be used to minimize the effects of grazing on the inputs of sediment and phosphorus into streams. Primary among these are:

- Off-site water development that draws livestock from perennial streams, thereby reducing impact on riparian areas

- Moving salt blocks away from water and heavily used meadows to improve distribution and forage utilization
- Fencing of riparian areas
- Pasture rotation
- Changes in the number of animals on an allotment
- Changes in the gender (steers vs. cow/calves), species, or age class on the allotment
- Forest management for percent of forage harvested or stubble height and forage species.

Forest Service. Grazing allotments in each forest are managed under an annual operating plan and a grazing permit. Several of the grazing allotments have been recently revised (PNF-sheep, BNF-Cascade Res.). The remainder of the allotments may be revised following the Forest Plan direction and activity schedules.

Idaho Department of Lands. Grazing practices in riparian areas are stipulated by management plans formed in conjunction with lessees. Streams are assessed for proper functioning condition and plans revised as needed. Since cattle can move freely across property lines, grazing leases and grazing management plans are coordinated with Boise Cascade Corporation.

Boise Cascade Corporation. Grazing leases require compliance with grazing management plans. Over the years, Boise Cascade has been working to identify ways to improve grazing management and incorporates those improvements into the management plans. Planned actions to reduce phosphorus entering Cascade Reservoir and its tributaries include the development of off-site watering areas, revisions of salting practices, development and implementation of a pasture rotation system, stubble height requirements, and other practices that will move cattle out of bottom lands and ensure adequate vegetation is present to capture sediment and phosphorus.

Measuring the Effectiveness of Different Management Measures

Two processes are currently in place to evaluate forestry BMP implementation and effectiveness. These are: (1) annual audits of the Forest Practices Act by Idaho Department of Lands to determine if BMPs are being implemented on federal, state, and private lands; and (2) BMP effectiveness evaluations completed by DEQ every 4 years.

The Forest Service also has performed monitoring of timber sale activities, including road construction. These include project level monitoring for BMP implementation and effectiveness of the IFPA. Monitoring has also been conducted on grazing allotments.

Forest Implementation Plan Monitoring

Forest landowners will monitor implementation and effectiveness of activities conducted to reduce sediment/phosphorus loading. Potential indicators may be quantitative (e.g., laboratory analysis of phosphorus concentrations in water exiting a created wetland) or qualitative (e.g. visual determination that there is less sediment in the water passing through a fenced riparian area) depending on the BMP implemented and the overall scope of the project. Road and slope stabilization construction activities will be inspected for completeness and adequacy of work. Construction dates and inspections will be documented in a written form at the completion of each task. Selected construction sites will be photographically monitored. Photographic documentation will also be done for a representative range of treatments. Photographs will be taken prior to and after road and slope construction activities from established photo locations. Implementation of the grazing plans will also be photographically documented.

The effectiveness of various road improvements in reducing sediment runoff to streams will be regularly monitored using sediment traps. Sites will be checked during the course of the year to ensure that the traps are not full. Traps will be pulled and the quantity of sediment measured either at the end of one year or when the trap fills. Traps that fill before the end of the year will be reset after they are emptied. Sediment traps will also be reset following the completion of road projects and will then be allowed to collect sediment for an additional year. The effectiveness of slope stabilization projects will be assessed through photographic monitoring. Photographs will be taken at least annually and after major storm events, conditions permitting. Monitoring of riparian vegetation and stream conditions will also be conducted to document changes in streamside habitat resulting from changes in grazing management. Established streambank/riparian vegetation acts as an effective buffer to the transport of animal wastes into the stream channel, and drastically reduces sediment delivery from bank erosion. Thus the condition of the streambank/riparian vegetation can be used as a qualitative indicator of grazing impacts on a surface water body.

In addition, the comprehensive, watershed-wide inflow and inlake monitoring used by DEQ to establish current loadings will continue as a mechanism to document improvements, identify initial loading trends, assess load reductions achieved and determine when the overall 37% reduction goal is attained. This monitoring is conducted on a monthly basis and can be used in a quantitative sense to determine the collective effectiveness of BMPs installed or implemented on tributary systems.

Agricultural Source Implementation Plan

Agricultural land encompasses 66,344 acres of the Cascade Reservoir watershed, accounting for 24 percent of the total land area. The Phase II TMDL indicates that agriculture contributes a total of 13,594 kg/yr of phosphorus. The estimated management load from agriculture was decreased by 5,118 kg/yr in the Agriculture Source Plan because the stakeholders agreed that the estimated agricultural load in the Phase II TMDL for the NFPR was probably overstated. Sources of load in the NFPR are not well quantified and the load assigned to agriculture in this subwatershed was four to ten times higher, in terms of the phosphorus yield coefficient (kg/ac/yr), than agricultural loading in other similar subwatersheds (see Table 2). The TAC decided to address this data gap in three steps:

1. Recalculate the agricultural load for the NFPR for the implementation plan using yield coefficients (kg/ac/yr) calculated by the Agriculture Source Group consistent with agriculture loads from similar, adjacent subwatersheds;
2. Conduct monitoring to better quantify sources contributing phosphorus load to the NFPR; and
3. Reassess source contributions and necessary phosphorus reductions by or before 2003 when the Phase II TMDL results and accomplishments are reviewed.

As a result of the recalculation, the estimated agriculture management load for the NFPR subwatershed is 1,876 kg/yr. The Agriculture Source Plan identifies 9,093 kg/yr of total phosphorus load (management and natural) from agricultural lands. A reduction of 3,485 kg/yr, or about 38% of agriculture management load, is needed to achieve the 30 percent reduction goal.

It should be clearly understood that the 5,118 kg/yr removed from the agriculture-based loading assessment above remains part of the monitored inflowing load to the reservoir, and an appropriate reduction from this amount will be required in order to meet the overall 37% reduction goal. With the collection of additional information and data as outlined previously, a reduction allocation will be assigned to this amount following the determination of the source(s) and the identification of appropriate reduction measures.

Approach to Determining Implementation Measures

Total phosphorus yield coefficients expressed as kg/acre/yr (Table 2) were used to calculate nonpoint source loads in each subwatershed. These yield coefficients were estimated from monitoring data, as described in the Phase II TMDL and supporting source plans, and were used as a basis for establishing a subwatershed-based priority ranking for implementation (as described in the preceding sections). These coefficients, on a management or practice specific basis, have been used to establish a

priority ranking within the nonpoint source-based loading for each subwatershed. Through this prioritization process, the total phosphorus loading from Tier 1 acreages (land within 150 feet of either side of a stream) has been identified as the highest priority for implementation of reduction measures within the Agricultural Source Implementation Plan.

The Agriculture Source Implementation Group identified the measures needed to meet the goal of a 30 percent reduction of total phosphorus load. The overall approach is to seek voluntary implementation of best management practices (BMPs) on agricultural lands. The *Cascade Reservoir Agricultural Source Implementation Plan,* provides a more detailed description of the proposed approach for achieving phosphorus reductions from agricultural non-point sources.

The approach for determining the measures needed to meet the agriculture load reduction goal is based on a three-tier classification of lands. Tiers were defined and lands classified considering agronomic, geomorphologic and hydrologic characteristics of agricultural land in the watershed. The land-use tiers are:

Tier 1 - All lands within 150 feet of either side of a stream - 7,598 acres.
Tier 2 - Lowlands, mostly irrigated crops and pasture - 37,256 acres.
Tier 3 - Uplands, mostly non-irrigated pasture - 21,490 acres.

An initial goal of treating 100 percent of Tier 1 lands was used to determine reduction measures. Tier 1 lands are particularly important for reducing phosphorus loads to the reservoir. Tier 1 lands are both potentially significant sources of phosphorus and important buffers for the stream. Virtually all the potential phosphorus load from these lands is delivered to streams because of their immediate proximity. Healthy riparian areas on Tier 1 lands are able to capture and assimilate orthophosphate into plant biomass, slow overland flow of runoff and contain sediment. Tier 2 lands are also considered to be significant contributors of phosphorus. Tier 3 lands are the furthest from riparian areas and are not considered to be significant contributors of phosphorus in most cases. The goal for Tier 3 lands is to limit the movement of sediment from these to lowlands and riparian areas.

Appropriate and effective component BMPs were identified for each land-use tier. These practices may be applied individually or as a total system with multiple component practices, depending on the specific characteristics of a land unit. Best management practices were selected considering land use, typical farming practices and effectiveness at reducing phosphorus. The seasonal nature of phosphorus loading was also considered in selecting BMPs. Seventy to eighty percent of nutrient loading to subwatershed streams occurs during snow melt and storm event run-off, and BMPs are selected to reduce this spring load as much as possible.

Total acres for each tier needing treatment were calculated by subwatershed using: (1) yield coefficients from the Phase II TMDL to calculate pre-treatment load; and (2) average reduction efficiencies for BMPs selected for each tier. The calculation was based on the general goals of 100 percent treatment of Tier 1 lands and 75 percent treatment of Tier 2 lands. BMPs and assumed efficiencies for each tier are specified in the Agricultural Source Implementation Plan.

Proposed Implementation Measures

Voluntary application of BMPs on 6,342 acres of Tier 1 lands, 26,636 acres of Tier 2 lands and 4,218 acres of Tier 3 lands in the watershed can meet the reduction goal for agricultural management load. The number of acres to be treated by subwatershed is shown in Table 5.

On a watershed-wide average, treatment of 83 percent of Tier 1 lands and 71 percent of Tier 2 lands will achieve the 30 percent reduction goal. When considered on a subwatershed-specific basis, the treatment of 83 percent of Tier 1 and 71 percent of Tier 2 lands will result in the attainment of the 30 percent nonpoint source reduction goal except in the Gold Fork and West Mountain subwatersheds where the proportion of Tier 1 and Tier 2 land is very low. Treatment of Tier 3 lands however, demonstrates a very low cost-efficiency associated with phosphorus reductions from BMPs implemented on these lands. Therefore, if the opportunity exists to achieve higher than the target reductions on Tier 1 and 2 lands in other subwatersheds, this will be pursued over reductions on Tier 3 lands in West Mountain and Gold Fork. The initial effort of this plan is to treat all Tier 1 acres first, followed by those Tier 2 acres necessary to achieve the required reductions. Specific tiered acreages requiring treatment are summarized in Table 5.

Due to the voluntary nature of agricultural BMP implementation, practices will be installed as landowners agree to participate. However, high priorities for BMP implementation can be generally identified as follows:

- Tier 1 lands - 100 percent of land treated
- Tier 2 lands – 75 percent of lands treated
- Lands in subwatersheds with higher yield coefficients (Boulder/Willow, Lake Fork, North Fork)
- Lands prone to sediment and phosphorus runoff during spring
- Practices that hold sediment and phosphorus on site (source control)

The actual design and installation of BMPs is a site-specific process. A conservationist from Valley Soil and Water Conservation District, the Soil Conservation Commission or the Natural Resources Conservation Service evaluates current practices, land characteristics and the potential for sediment and phosphorus runoff from a particular

land unit and recommends specific practices for a farm in the form a conservation or nutrient management plan. Typically, a land owner enters into an agreement that specifies design, installation and maintenance requirements, indicates the number of years the land owner agrees to maintain the BMPs, and provides cost share funds to support implementation.

The following types of BMPs may be installed.

Tier 1 BMPs

- Fencing
- Prescribed grazing systems
- Heavy use area protection
- Offsite watering
- Stream channel stabilization
- Filter strips

Tier 2 BMPs

- Irrigation water management
- Stock water development
- Irrigated systems
- Wetland development
- Ponds
- Prescribed grazing systems

Tier 3 BMPs

- Prescribed grazing systems
- Fencing
- Ponds
- Spring/stockwater development
- Critical area planting
- Range seeding

Table 5. Agricultural Load Allocation and Reductions Required by Tier to Meet Phase II TMDL Goals (Listed by Subwatershed)

Subwatershed	Tier1 Acres	Tier 1 Load (kg)	Tier 1 Load Reduction (kg)	Tier 1 Acres Requiring Treatment[1]	Tier 2 Acres	Tier 2 Load (kg)	Tier 2 Load Reduction (kg)	Tier 2 Acres Requiring Treatment[2]	Tier 3 Acres	Tier 3 Load (kg)	Tier 3 Load Reduction* (kg)	Tier 3 Acres Requiring Treatment[3]
Boulder/ Willow	1,079	376	170	638	8,304	1,910	732	5,306	2,213	67	0	0
Cascade	727	26	18	717	4,132	145	92	3,796	3,259	117	0	0
Gold Fork	890	98	71	874	3,143	314	199	3,133	3,437	399	40	861
Lake Fork	1,228	424	261	1,015	6,504	1,821	697	4,151	2,668	256	0	0
Mud Creek	1,062	126	51	549	9,290	576	221	5,930	491	8	0	0
NF Payette	1,374	272	194	1,320	5,762	1,268	567	4,209	4,256	446	0	0
West Mtn	1,238	113	82	1,229	121	6	3	111	5,166	325	84	3,357
Total	7,598	1,435	847	6,342	37,256	6,040	2,511	26,636	21,490	1,618	124	4,218

***** Because of the declining cost-efficiency of treating Tier 3 acres, all acres required for reduction except in the case of West Mountain have been reallocated to the Tier 1 and 2 reduction requirements. This allows for the implementation of BMPs in tiers where the most beneficial use may be obtained with the money spent.

[1] Tier 1 acres requiring treatment based upon calculations made in the Phase II TMDL Agricultural Source Plan using an efficiency rating of 70 percent for BMPs implemented in tier I acres.
[2] Tier 2 acres requiring treatment based upon calculations made in the Phase II TMDL Agricultural Source Plan using an efficiency rating of 60 percent for BMPs implemented in tier II acres.
[3] Tier 3 acres requiring treatment based upon calculations made in the Phase II TMDL Agricultural Source Plan using an efficiency rating of 40 percent for BMPs implemented in tier III acre

Agriculture Implementation Plan Monitoring

The objectives of an agriculture-monitoring plan are to verify that BMPs are properly installed, are properly maintained and are operating as designed. Monitoring for agricultural phosphorus reductions will consist of spot checks, annual reviews and evaluation of advancement toward reduction goals. Monitoring may be qualitative or quantitative, depending on the project. Evaluation of advancement toward reduction goals will be accomplished using a project tracking system currently being developed and annual reports discussed later in this Implementation Plan.

For state-funded projects, spot checks of BMPs will be part of the annual review now required for projects implemented under the State Agriculture Water Quality Program (SAWQP). Landowners will be contacted and visited to review contracts and discuss the need for any changes to the BMPs. The BMPs will be evaluated using the performance criteria outlined on the form included in the Agriculture Implementation Plan. Federal cost-share programs provide for both evaluations of resources during planning and spot checks during annual reviews.

In addition, the comprehensive, watershed-wide inflow and inlake monitoring used by DEQ to establish current loadings will continue as a mechanism to document improvements, identify initial loading trends, assess load reductions achieved and determine when the overall 37% reduction goal is attained. This monitoring is conducted on a monthly basis and can be used in a quantitative sense to determine the collective effectiveness of BMPs installed or implemented on tributary systems.

Urban/Suburban Source Implementation Plan

Urban/Suburban land use totals 25,945 acres within the watershed, representing 9.4 percent of the total land area. The major urban/suburban centers in the Cascade Reservoir watershed are the incorporated cities and city impact areas of Cascade (population ~1,120), Donnelly (population ~200) and McCall (population ~2,600). A significant increase in total watershed population occurs during summer months when part-time residents and tourists frequent the area.

Phosphorus load reduction attributable to the transient population will be addressed to the extent possible through structural improvements, such as stormwater runoff and roadway improvements; and through behavioral improvements such as runoff/drainage and fertilizer management. Rural ranchettes with hobby livestock and other domestic livestock, including their respective drives/driveways are included in the agricultural sections of the implementation plan. The public and private roads/highways included in this section of the implementation plan are exclusive of those covered in the forestry sections of the implementation plan.

Approach to Urban/Suburban Implementation Measures

Total phosphorus yield coefficients expressed as kg/acre/yr (Table 2) were used to calculate nonpoint source loads in each subwatershed. These yield coefficients were estimated from monitoring data and associated modeling efforts, as described in the Phase II TMDL and supporting source plans, and were used as a basis for establishing a subwatershed-based priority ranking for implementation (as described in the preceding sections). These coefficients, on a management or practice specific basis have been used to establish a priority ranking within the nonpoint source-based loading for each subwatershed. Through this prioritization process, the total phosphorus loads from urban stormwater, roadways (private and public), and failing/out-of-compliance septic systems have been identified as the highest priorities for implementation of reduction measures within the Urban/Suburban Source Implementation Plan.

Within this document, septic-related phosphorus loading is discussed separately because of differences in phosphorus load delivery and treatment mechanisms related to this source.

As initial goals and objectives to meet the reductions outlined above and in the Phase II TMDL and the *Cascade Reservoir Watershed Urban/Suburban Source Plan: Phase II TMDL*, the Urban/Suburban Source Group has established the following watershed-wide actions:

- Universal adoption of the *Handbook of Valley County Stormwater Best Management Practices* as an ordinance by local governments will be encouraged.

- Municipalities throughout Valley County will be encouraged to implement development design strategies that are source-control oriented (i.e., on-site detention programs, minimizing directly connected impervious areas, site finger-printing, local urban forestry, etc.). Through design, the natural and landscaped site drainage system can work effectively to soak, filter and temporarily pond runoff. These local programs protect water quality through advocating and enforcing when necessary, the assurance that rates of post-development runoff from a given site do not exceed the rate of pre-development runoff.

- Suspended solids cause many problems for water quality in addition to increasing concentrations of total phosphorus in the water column. Therefore, a county-wide erosion and sediment control ordinance that includes provisions for performance standards that allow for a combination removal of both total phosphorus and total suspended solids will be encouraged.

- Municipalities will be encouraged to set aside and/or donate sensitive lands that posses intact riparian vegetation, "classified" wetlands, steep slopes, and areas of highly erodible soil types. When intact riparian vegetation and wetlands are radically altered, they lose their function as natural collection, filtering and storage systems. However, if they are kept intact, the natural landscape provides for the above mentioned beneficial functions.

Under the comprehensive scope of the items outlined above, specific projects will be designed to meet the overall reduction goals.

Specific BMP selections, and site emplacement locations will be determined by the municipalities; county policy; local governments, associations or agencies; and funding appropriation requirements. It is understood that BMPs will be selected from the approved BMP lists contained in *The Handbook of Valley County Stormwater Best Management Practices (1997),* the *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties,* and the *Stormwater BMP Selection Suitability Decision Tree (DEQ, 1999*, a copy of which is available in the Urban/Suburban Source Implementation Plan, Appendix C*).* Site specific BMP emplacement will be the responsibility of local government authorities and will be documented within a facilities plan or other appropriate document. For load reduction accounting purposes, copies of this documentation and all subsequent site evaluations will be submitted to the Cascade Reservoir TAC for subsequent input to the Cascade Reservoir Implementation Database established for all nonpoint sources within the Cascade Reservoir watershed.

Approach to Determining Stormwater-Related Implementation Measures

The Urban/Suburban Source Implementation Plan approach to phosphorus load reduction in stormwater addressed the stormwater drainage system as a whole. With

this approach, all urban/suburban lands contributing runoff were under consideration for control measures. The magnitude of stormwater runoff from each area was calculated using land use acreage, annual precipitation averages and percent impervious surface for urban/suburban lands within the watershed. Land use data and acreage breakdowns were obtained for each municipality from Valley County Tax Assessor records. Precipitation data were available from two climatological stations within the watershed in the cities of Cascade and McCall. Estimates of impervious surface areas and runoff coefficients were extracted from both the "Big Payette Lake Technical Report" (DEQ, 1997) and the EPA stormwater guidance manual (EPA, 1992). The above information and the average pollutant concentrations for the designated land uses were used to calculate the total loading contribution from urban land within the watershed, as discussed in the *Cascade Reservoir Watershed Urban/Suburban Source Plan: Phase II TMDL (DEQ, 1998a)*. The estimated stormwater-related phosphorus load originating from the three cities within the Cascade Reservoir watershed is 1,270 kg/yr. The estimated stormwater-related phosphorus load originating from rural subdivisions is 638 kg/yr.

Prioritization of stormwater implementation within the municipalities and rural subdivisions will focus on: (1) Source control measures to minimize or eliminate pollutant impacts to stormwater runoff. (2) Improvement of existing transport corridors to encourage unobstructed, low velocity movement of stormwater and discourage extended shallow ponding; (3) Improvement of sedimentation or other passive treatment mechanisms immediately prior discharge into surface waters; and (4) Emplacement of stormwater treatment trains in those locations for which diversion/sedimentation is not possible prior to discharge to surface waters.

An initial goal of treating municipal stormwater loading to achieve a 35 percent total phosphorus reduction (445 kg/yr) was established. A concurrent goal of treating rural residential stormwater loading to achieve a 25 percent (160 kg/yr) total phosphorus reduction was also established. The load reduction goal for rural residential subdivisions was more conservative than that for municipal stormwater because of the lack of centralized stormwater systems in rural subdivisions and the increased difficulty of treating individual runoff locations in these areas.

The cities of Cascade and Donnelly, and City of McCall drainage basins 9, 11, and 13 (*Stormwater Retrofit Options for Valley County*) were determined to represent the greatest potential contributors of total phosphorus and suspended solids based on the current land uses. The projects with the greatest cost-benefit ratio were determined to be those located in the Boulder/Willow Creek, Mud Creek, Cascade, and North Fork Payette River subwatersheds.

<u>Proposed Stormwater-Related Implementation Measures</u>

As noted above, the cities of Cascade and Donnelly, and City of McCall drainage basins 9, 11, and 13 represent the greatest potential contributors of total phosphorus and suspended solids based on the current land uses. The projects with the greatest cost-benefit ratio were determined to be those located in the Boulder/Willow Creek, Mud Creek, Cascade, and North Fork Payette River subwatersheds. A significant amount of progress in the improvement of stormwater runoff treatment has been accomplished recently in the City of McCall and those areas of the City of Cascade that drain into the Cascade Reservoir watershed. These reduction efficiency of efforts will be fully assessed and reported in an annual reporting sequence established for the implementation process (starting Fall 2000).

With the current level of progress in mind, and the subwatershed priority ranking discussed previously, the highest priority ranking for additional treatment of municipal stormwater within the watershed was assigned to the City of Donnelly, located predominantly in the Boulder/Willow subwatershed, as this location experiences significant stormwater flows during snowmelt and spring runoff. Donnelly has the potential to contribute significantly to water quality impacts to Cascade Reservoir due to its close proximity and existing rudimentary stormwater control/treatment system. Improvements and/or upgrades to both stormwater and wastewater collection and treatment systems, are necessary to prevent continuation of snowmelt/runoff transported loadings.

Two initial projects have been identified for management of stormwater flows in association with the City of Donnelly. The first project identified for improving stormwater management targets the ponding of spring runoff water in and around the City of Donnelly. The proposed projects focuses on the manipulation of existing flow channels (located immediately west of the City of Donnelly) through removal of seven small, abandoned irrigation dam structures to allow better flow characteristics in the area of Boulder Creek, followed by the augmentation of several existing sediment ponds lower in the drainage, and removal of identified debris that obstructs flow and creates the opportunity for significant bank erosion in some areas.

Preliminary engineering and site assessments have shown that the overall slope for the existing channel system is less than 0.5%. With this shallow slope, water from snow-melt ponds behind the upper, existing seven structures and creates standing pools (often 7 to 9 inches in depth) over large areas of the land within and immediately surrounding the City of Donnelly. This standing water leads to anaerobic conditions in the soil, followed by the subsequent release and transport of phosphorus to surface waters and, eventually, the reservoir. Improvements in the flow channel to encourage slow-flow movement of the runoff water, combined with augmentation of sediment ponds on the downstream segments, will reduce ponding/anaerobic potential on the upstream segments, and enhance sediment removal before entering the reservoir. Thus, while ponding will occur, it will be limited to smaller, deeper areas in the form of sediment ponds which result in the removal of both sediment particles and the associated bound

phosphorus, not large shallow areas that lead to higher bioavailable phosphorus concentrations in the water discharging to the reservoir. Areas with substantial debris accumulation due to previous high velocity flows will be cleared to allow unrestricted, low velocity movement of water within the re-engineered drainage system and reduce the potential for culvert and bank destabilization from debris accumulation during high flow periods.

The second project involves the installation of stormwater treatment mechanisms in channels that discharge directly to Boulder Creek and are not possible to treat in the above manner. There are three primary drainage paths in the City of Donnelly that discharge directly to Boulder Creek. The stormwater treatment trains installed in these drainages will consist of a physical filtration mechanism to remove large debris, followed by a vortex-based separation mechanism designed to remove sediment, bacteria and non-dissolved organic material, followed in turn by an iron-rich sand filter to remove dissolved phosphorus and fine suspended materials.

Similar systems have been proposed for the treatment of stormwater from the designated drainage basins for the City of McCall. Outside funding support in the form of 319 Grant proposals for the City of Donnelly and the McCall drainage basins has been secured. Federal 319 Grant monies were used to complete stormwater upgrades in 1999 and work is ongoing for the 2000 construction season in both Donnelly and the McCall drainage basins. Additional funding for both Donnelly and McCall has been requested for the 2001 through 2003 construction seasons. If attained, work will be initiated in the spring/summer of 2000.

These projects represent an initial but ongoing effort to improve stormwater runoff to the reservoir. Similar projects will be implemented throughout the watershed. Data and operational information from passive and active treatment systems currently proposed or in place will be used to identify treatment practices and mechanisms that will work effectively for other discharge areas. Both passive (i.e. gravel and vegetated filter strips) and active (i.e. sand filter installation) treatment mechanisms will be implemented.

Future recommended BMPs and changes in management practices will seek to control phosphorus loading through the reduction or treatment of runoff volumes and sediment transport in an efficient and cost-effective fashion. The majority of the recommended BMPs pertain to controlling pollution at the source and include both residential and commercial development source treatment measures. Source control measures will be implemented to focus on minimizing or eliminating the source of pollution so that pollutants are prevented from contacting runoff or entering the drainage system. Permanent BMPs and treatment control measures will be designed to remove pollutants after being taken up by runoff. Additionally, the cost-benefit ratio of potential retrofit options will be calculated to optimize potential projects within the watershed.

The following documents list acceptable BMPs for the Cascade Reservoir Phase II TMDL:

The *Handbook of Valley County Stormwater Best Management Practices, 1997,* and the *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties*. These references are recognized as the primary technical references for developers, contractors, design professionals, local agency officials and staff responsible for design, construction, maintenance or the review and approval of stormwater treatment facilities/devices. To prevent future impacts, the *Handbook of Valley County Stormwater Best Management Practices* will serve as a means of implementing consistent county-wide site design treatment considerations. The cities will be proactive and encourage more comprehensive strategies for stormwater planning and management.

Stormwater Retrofit Options for Valley County, 1996. This document provides a list of applicable BMPs, prioritized retrofit projects, and other recommendations for improving water quality on a subwatershed basis.

Procedures and Recommendations for Subwatershed Prioritization of Stormwater BMPs, 1997. This document describes a process for prioritizing stormwater BMPs by subwatershed based on the prevailing and site suitable physical conditions.

The Urban/Suburban Source Implementation Plan references the *Handbook of Valley County Stormwater Best Management Practices, 1997,* and the *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties* as these contain a complete list of site-specific BMP projects, phosphorus load reduction efficiencies, comparative costs and applicability for each of the recommended BMPs.

A selection matrix for identifying potential BMPs in the *Handbook of Valley County Stormwater Best Management Practices, 1997* will be utilized for BMP selection in correlation with the *Stormwater BMP Selection Suitability Decision Tree* included in the Urban/Suburban Source Implementation Plan. Both of these documents will be available to the general public at the Valley County Planning and Zoning Office and the Cascade Satellite Office of DEQ.

Treatment options for urban/suburban stormwater are many and varied. It should be kept in mind that actual BMPs implemented may vary due to site requirements, land availability options, funding availability, and the needs of each separate municipality or subdivision.

Approach to Determining Roadway-Related Implementation Measures

Road erosion is the primary sediment source within urban/suburban land use. Minimization of sediment-bound phosphorus transport through the control of road-

related erosional processes is of high priority. Many roads within the watershed are steeply sloped, improperly designed, inadequately maintained, and include cuts and culverts that are in poor repair. Proximity to surface water is of primary concern, as direct transport of sediment is possible in many areas of the watershed. Sediment transport and erosional processes on these road systems is estimated to generate 15,721 tons of sediment per year, yielding approximately 2,515 kg of phosphorus annually, as shown in Table 4 of the Urban/Suburban Source Implementation Plan (Appendix C).

Initial transportation-based load reduction goals are to address 80 percent of the unimproved roads, 65 percent of graveled roads, and 35 percent of paved roads. Roads and highways within the Cascade Reservoir watershed will be expected to accomplish a load reduction of 754 kg/yr. Although it is not directly accounted for in the load calculations, the Idaho Transportation Department will be upgrading specific sections of State Highway 55 within the Cascade Reservoir watershed, which is also expected to result in water quality improvements.

Proposed Roadway-Related Implementation Measures

The Valley County engineer has completed a comprehensive inventory of private roads and highways. Many locations with erosion, predominantly those associated with unimproved roads, were observed during the inventory.

The prioritization of roadway implementation measures targets those roadways located in close proximity to a surface water system, in rolling or steep terrain that are especially at risk for rutting, rilling, and gullying. For the most part, this class of unimproved public and private roadway is best described as narrow, low volume traffic and poorly maintained. Approximately half of this class of unimproved public roads have been identified as high priority sites fitting the above description and are therefore proposed to be improved to a level of upgraded service that would stabilize the road surface and improve drainage to reduce erosion.

Roadways that fit the above description located in the Boulder/Willow, West Mountain and Lake Fork subwatersheds will be addressed first. Appropriate BMPs for roads and highways include graveling on native material roads, ditching and cross-drains with gravel interfaces and vegetated swales (on native and graveled roads), and culvert and ditch upgrade/repair for paved roadways.

A 319 Grant proposal targeting those roadways located in the West Mountain subwatershed identified as being in poor condition and having the greatest chance for direct transport to the reservoir has been approved. The majority of the work for 1999 has been completed and the remainder scheduled for the 2000 construction season. An additional 319 Grant proposal targeted roadways in the immediate vicinity of the reservoir that experience heavy recreational usage has been submitted and approved. Work is scheduled for the years 1999 to 2000. A 319 Grant proposal to address failing

road crossings in the Boulder/Willow subwatershed and additional private roadways at risk in the West Mountain subwatershed is in preparation and expected to be submitted for the 2002 funding schedule.

Stormwater and Road Monitoring

The objectives of an urban/suburban monitoring plan are to verify that BMPs are properly installed, that they are being maintained, and are working as designed. Monitoring for phosphorus reductions will consist of spot checks, annual reviews and evaluation of advancement toward reduction goals. Monitoring will be either qualitative or quantitative, depending on the project. Proposed projects may need to incorporate project monitoring into new grant proposals. Evaluation of advancement toward reduction goals will be accomplished using the project tracking system and annual reports.

In addition, the comprehensive, watershed-wide inflow and inlake monitoring used by DEQ to establish current loadings will continue as a mechanism to document improvements, identify initial loading trends, assess load reductions achieved and determine when the overall 37% reduction goal is attained. This monitoring is conducted on a monthly basis and can be used in a quantitative sense to determine the collective effectiveness of BMPs installed or implemented on tributary systems.

Septic Systems

Septic systems provide for sewage treatment and disposal in areas lacking municipal wastewater collection and treatment systems. Septic tank/soil adsorption systems may be a significant source of nutrients and other pollutant loadings to shallow groundwater, particularly in saturated soil conditions.

Approach to Determining Septic-Related Implementation Measures

Two areas adjacent to the reservoir (within 600 feet) with developed subdivision parcels were identified as potential nutrient source locations due to inadequate retention time and treatment of septic tank effluent caused by high ground water and poor soil retention characteristics. One area includes subdivisions aggregated around the north end of the reservoir, in the vicinity of the tributary arms of Boulder/Willow Creek and Lake Fork Creek. The other location includes the subdivisions in the southwest reach of the reservoir. It was recognized in the Phase II TMDL that both locations were dominated by high groundwater tables, evidence of groundwater contamination, high septic system density, and poor soil types.

The Phase II TMDL estimated the load contributed to the reservoir from septic systems at 2,205 kg/yr based on 1,795 septic systems and a range of effluent quality assumptions. As documented in the Urban/Suburban Source Implementation Plan,

approximately 650 residences have connected to a sewer system, although to date, not all have properly decommissioned their septic systems.

Proposed Septic-Related Implementation Measures

To address high phosphorus and bacteria loadings identified in the Phase 1 TMDL in the northern arms of the reservoir, the North Lake Recreational Sewer and Water District (NLRSWD) was formed. The NLRSWD is currently providing sewer service to approximately 650 subdivision residences aggregated around the north end of the reservoir, with additional residences expected to be connected to sewer and discontinue use of their septic systems in the near future. Approximately 60 septic systems in this area were unaccounted for as of December 1999. This sewer facility does not discharge to surface water. It is part of a partnership project with the approved City of Donnelly Wastewater Treatment Plant and relies on land application of the treated effluent. Treated effluent is applied at agronomic rates to an area of agricultural land in the eastern portion of the watershed. All application activities are conducted in areas where groundwater is deep below the surface and does not represent a transport potential for phosphorus or other pollutants of concern. The construction of the NLRSWD system has resulted in the removal of septic wastes that previously entered the reservoir in a nearly direct and immediate fashion from failing systems located in very close proximity to the reservoir. With proper decommissioning, the NLSWD connections are estimated to have reduced the total phosphorus loading to Cascade Reservoir by 838 kg/yr.

A second sewer district, the South Lake Recreational Water and Sewer District (SLRWSD) has been formed for the southwest shore and is currently seeking sources of funding to establish service. The southwest location (in the area of the West Mountain subwatershed) has a high groundwater table, evidence of groundwater contamination, a high density of septic systems and poor soil types. Many of the developed parcels in the West Mountain subwatershed have septic systems that predate 1985 (average age is 23+ years) and are not in conformance with contemporary standards. Two different wastewater treatment plant designs are being considered at this time: (1) Augmentation of the approved City of Cascade Wastewater Treatment Plant to increase the existing capacity to handle additional wastes piped from the SLRWSD area. This plant currently discharges treated effluent to the NFPR downstream of Cascade Reservoir, below the Cascade Reservoir watershed boundaries. (2) Construction of a separate, approved treatment facility in the SLRWSD area that will utilize land application in an area with appropriate soil and ground-water characteristics. All land being investigated as potential land application sites is located south of Cascade Reservoir. The current opinion is that the initial design (partnership with the City of Cascade) will be selected as an interim mechanism for wastewater treatment, followed by the construction of a land application-based treatment facility specific to the SLRWSD as over time, restrictions to surface water discharges are expected to become more stringent. To this end, significant progress has been made

toward the eventual sewering of the West Mountain area. Current plans include a joint effort with the City of Cascade to install a holding facility for wastewater at the current Cascade WWTP site. Holding tanks will be installed initially in those lots where septic systems are known or suspected to be failing or out of compliance due to age, high ground water conditions, poor soil characteristics or small lot sizes. These holding tank systems will then be upgraded to accommodate a pressurized sewer system at project completion. A 319 Grant proposal for construction of the holding facility has been approved and funded. The work is scheduled for the 2000 to 2002 construction seasons. A second 319 Grant proposal to assist in the emplacement of holding tanks in the SLRWSD area has also been approved and funded. The work is scheduled for the 2001 to 2002 construction seasons. At completion, the SLRWSD facility is expected to serve approximately 350 residences, with subsequent expansion over time. It is estimated that with proper decommissioning the initial 350 hookups will reduce Cascade Reservoir total phosphorus loadings by 706 kg/yr.

It is recognized that septic systems must be decommissioned properly to result in a 100 percent removal of the potential pollutant load they represent. Current Central District Health Department (CDHD) policy requires that abandoned septic tanks must be pumped, filled with sand or collapsed.

With the completion of the winter storage ponds for the McCall WWTP, no treatment systems authorized to accept septic wastes will discharge to surface water within the watershed. Therefore, 100 percent removal of the septic-related pollutant loading from properly decommissioned systems is possible, and does not represent only a relocation of load within the watershed.

Of the total estimated septic system phosphorus load of 2,205 kg/yr, the NLRSWD reduction of 838 kg/yr and SLRWSD reduction of 706 kg/yr combine for a total load reduction of 1,544 kg/yr. The cost of NLRSWD sewer connections was approximately $6,000 each, plus $350 to $450 per connection for septic system decommissioning. The total cost for 650 NLRSWD systems is approximately $4,193,000. The estimated cost of SLRWSD sewer connections range from $8,000 to $11,000 each (which includes decommissioning). The total cost for 350 SLRWSD systems is approximately $3,850,000 (this cost reflects per-site hookup and decommissioning charges only, the current total system construction/operation cost estimates are higher based on additional system requirements). Using these conservative figures, the total estimated capital cost for the septic system load reduction of 1,544 kg/yr is $8,043,000.

Septic System Load Reduction Monitoring

Monitoring of the septic tank phosphorus load reduction consists of tracking the number of residences that connect to a sewer system and decommission their septic systems. Monitoring includes inspection and reporting of decommissioned septic tanks. This inspection and reporting is the responsibility of the CDHD, the State Plumbing Inspector, and the decommissioning contractor.

In addition, the comprehensive, watershed-wide inflow and inlake monitoring used by DEQ to establish current loadings will continue as a mechanism to document improvements, identify initial loading trends, assess load reductions achieved and determine when the overall 37% reduction goal is attained. This monitoring is conducted on a monthly basis and, as several monitoring sites are located in close proximity to both the NLRSWD and the SLRWSD boundaries, can be used in a quantitative sense to determine the collective effectiveness of septic to sewer conversions, septic decommissioning and other associated measures completed.

Urban/Suburban – Load Reduction Summary

Urban/Suburban phosphorus load reductions for municipal stormwater, rural residential stormwater, roadways, and septic systems are summarized in Table 6.

Table 6. Average Total Phosphorus Load and Reduction Goals for Urban/Suburban Sources

Nonpoint Sources	Total Phosphorous, [a] kg/yr	Land Use Treated, [b] Percent	Reduction Goal, kg/yr	Percent Reduction, percent
Urban/Suburban Municipalities Stormwater[b]				
City of Cascade	222	100	78	35 percent
City of Donnelly	151	100	53	35 percent
City of McCall	897	100	314	35 percent
Total Municipal Stormwater[b]	1,270	100	445	35 percent
Rural Residential Subdivisions Stormwater[b]	638	100	160	25 percent
Roads and Highways				
Unimproved	434	80	295	85 percent
Gravel	1,247	65	365	45 percent
Paved	601	35	95	45 percent
State Hwy 55	234	0	0	0 percent
Total Transportation	2,515		754	30 percent
Subtotal Stormwater and Roads and Highways	4,423		1,359	
Septic Systems	2,205		1,544	70 percent [c]
Total Urban/Suburban	6,628		2,903	44 percent

[a] These figures include both the management load shown in Table 1 and the natural and background loads specific to these sources.
[b] The 100 percent treatment designation indicates the intent to pursue a system-wide approach to stormwater management.
[c] The septic system load reduction results from both water quality and public health driven priorities. Provision of wastewater collection and treatment facilities is accomplished on service area basis as opposed to an individual, site specific basis.

Created Wetlands

In addition to the land-use specific BMPs outlined in the preceding discussion and the accompanying source-based implementation plans, created wetlands were constructed in 11 areas of the reservoir shoreline between 1995 and 1999. Collectively, these wetland areas occupy roughly 60 acres of land, and receive and treat approximately 1,100 acre-feet of water annually from an estimated 17,000 acres of agricultural and forestry land. These wetlands were constructed through joint efforts by the USBR, DEQ, the Cascade Reservoir Association, CRCC, IDFG and volunteers from the Boy Scouts of America and the local community. They are administered by the USBR.

Wetland monitoring is conducted jointly by USBR and DEQ. Monitored parameters consist of nutrient and heavy metal loading evaluation, temperature, dissolved oxygen and flow assessments, and bacterial concentration in the inflowing and outflowing waters.

Because wetlands in other areas have been shown to be effective in the reduction or removal of dissolved phosphorus from inflowing waters, these projects are expected to result in significant phosphorus load reduction to Cascade Reservoir. In addition, they are projected to provide sediment reduction, erosion protection and improved wildlife habitat. Commonly, created wetlands require 3 to 5 years to mature as efficient phosphorus reduction treatment systems. These wetlands are monitored monthly during the ice-free season and preliminary data trends in the most mature wetlands show that the projected reductions are occurring. Monitoring will continue, and as collected data show consistent reduction trends, the operational efficiencies of these projects will be determined and the reductions achieved will be distributed according to the proportional land-use acreage within the drainage areas of each created wetland.

Several other created wetlands are currently proposed for areas of tributary drainage and stormwater treatment in urban/suburban land use. The design, siting and construction of these proposed wetlands will draw heavily on the techniques learned and information gained while developing and monitoring the existing created wetlands.

Summary of Proposed Point and Nonpoint Source Reductions

Table 7 and 8 summarize all point and nonpoint source estimated phosphorus reductions achieved by reduction measures outlined in this implementation plan. Estimated reductions are shown by subwatershed where source plans provide that information, otherwise, estimated reductions are shown as a total for the watershed.

The estimated reductions from implementation measures identified in this plan are not enough to meet the total nonpoint source load reduction goal of 10,895 kg/yr, in part because they do not include reductions for 5,118 kg/yr of load from the North Fork Payette River (NFPR) subwatershed. As described in the Agricultural Source Implementation Plan section, the sources of this load have not been well defined. DEQ has undertaken a monitoring program to better determine the sources of this load. Specific reduction measures will be identified and implemented when the source identification monitoring is complete, to achieve a 30 percent reduction of total load.

The plan also does not identify implementation measures to reduce the background load entering the NFPR and Lake Fork Creek, from Big Payette Lake (estimated at 1,717 kg/yr) and Little Payette Lake (estimated at 281 kg/yr), respectively. Background loads from Big Payette Lake are currently being addressed under the Big Payette Lake Management Plan and Plan Implementation Program. Actions taken to improve water quality conditions in Big Payette Lake will reduce phosphorus loads flowing into the NFPR. Background loads from Little Payette Lake will be addressed by an agreement between Water District #65K, the Lake Irrigation District, and Water District #65 for management of irrigation water from Little Payette Lake. The management scenarios identified in this agreement are expected to result in improved water quality and fish habitat in Lake Fork Creek and, as an end receiver, Cascade Reservoir. The management agreement is expected to continue indefinitely, with the exception of extreme dry (drought) years, or in the event of substantial revision to the current flow augmentation scenarios for salmon flush waters.

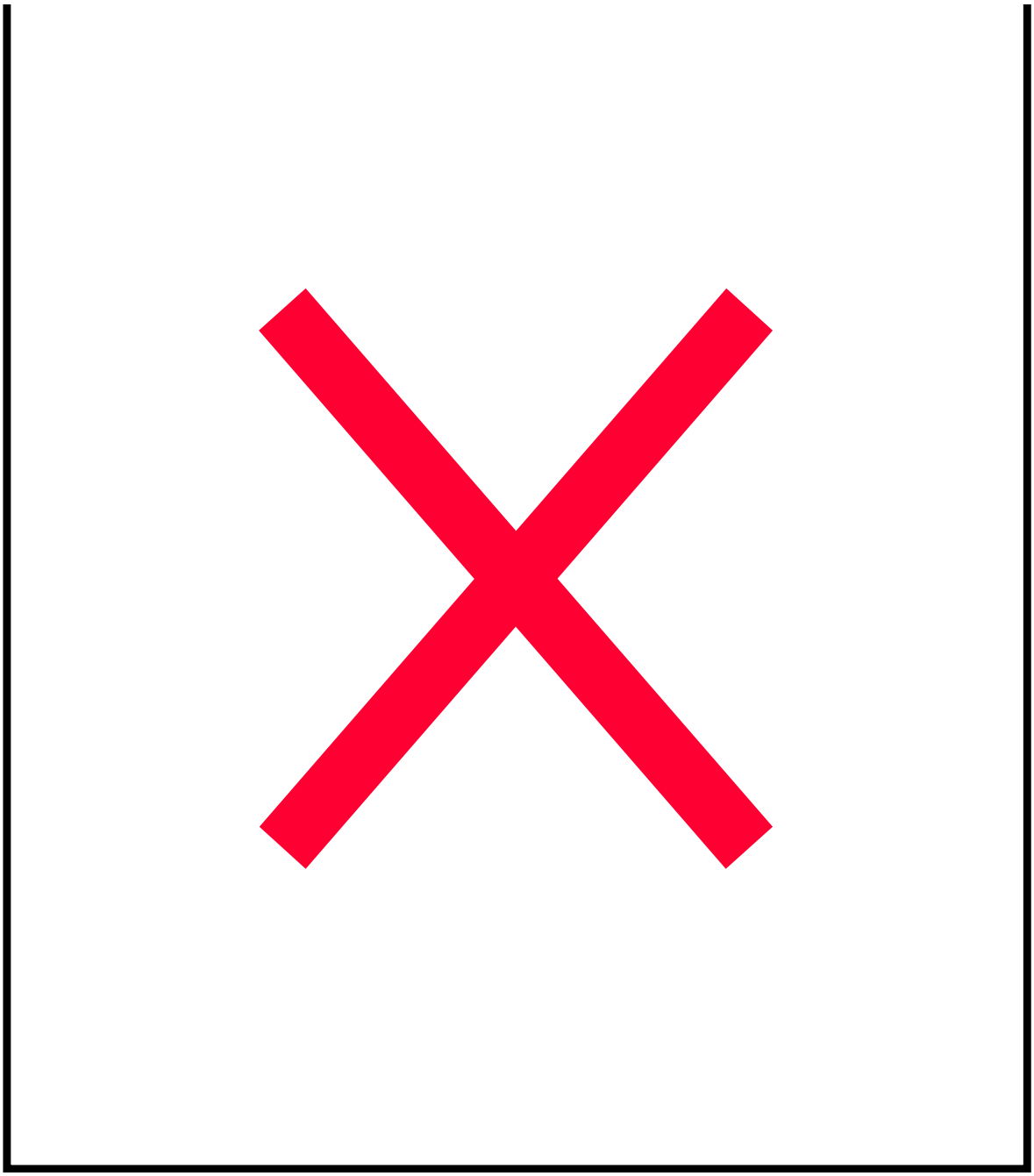
If the NFPR total load is reduced by 30 percent once the unknown sources are identified, and the Big Payette Lake and Little Payette Lake efforts reduce the background loads by 30 percent, the total load reduction goal for the Phase II TMDL will be achieved.

A formal evaluation of all reduction measures within the Cascade Reservoir watershed will be completed in 2003 and trends toward water quality goals will be identified. The re-assessment of proposed implementation measures will be carried out at this time for all sources within the watershed. If trends indicate that reduction goals will not be achieved under the existing management plan, more stringent reduction measures will be outlined within the progress report generated and further implementation measures will be put in place.

Monitoring of the specific sources listed above will continue under the DEQ monitoring plan through at least 2003. Periodic reviews of the data will be undertaken to identify potential trends in phosphorus loading. These issues will also be re-evaluated in depth in 2003, and an assessment will be performed of the reduction status for both the measured load from North Fork Payette River subwatershed and the background loads Big Payette Lake and Little Payette Lake. If trends indicate that reductions are proceeding and that designated reduction goals will be met in an appropriate time frame, implementation will proceed as outlined. If trends indicate that reduction goals will not be achieved under the existing management plans for Big Payette Lake and Little Payette Lake, more stringent reduction measures will be outlined for these contributing systems within the progress report generated and further implementation measures will be put in place.

As stated earlier, additional monitoring and review of the North Fork Payette River subwatershed is necessary to target phosphorus reduction BMPs in the most efficient and cost effective manner possible. Monitoring is continuing and funding sources for acquisition of additional data for this subwatershed are being actively sought. Additional monitoring will be undertaken in the timeliest manner available. At current funding levels, additional data acquisition is expected to occur within the next four years, at which time the subwatershed priority ranking will be re-evaluated and the North Fork Payette River subwatershed listed at the appropriate level based on the factors outlined previously. An assessment of data collected and evaluation of progress toward this goal will be undertaken in 2003. If possible, a priority ranking of this subwatershed will be undertaken at that time. If additional data is necessary, a listing of data gaps remaining will be prepared and funding sources identified to complete the source evaluation.

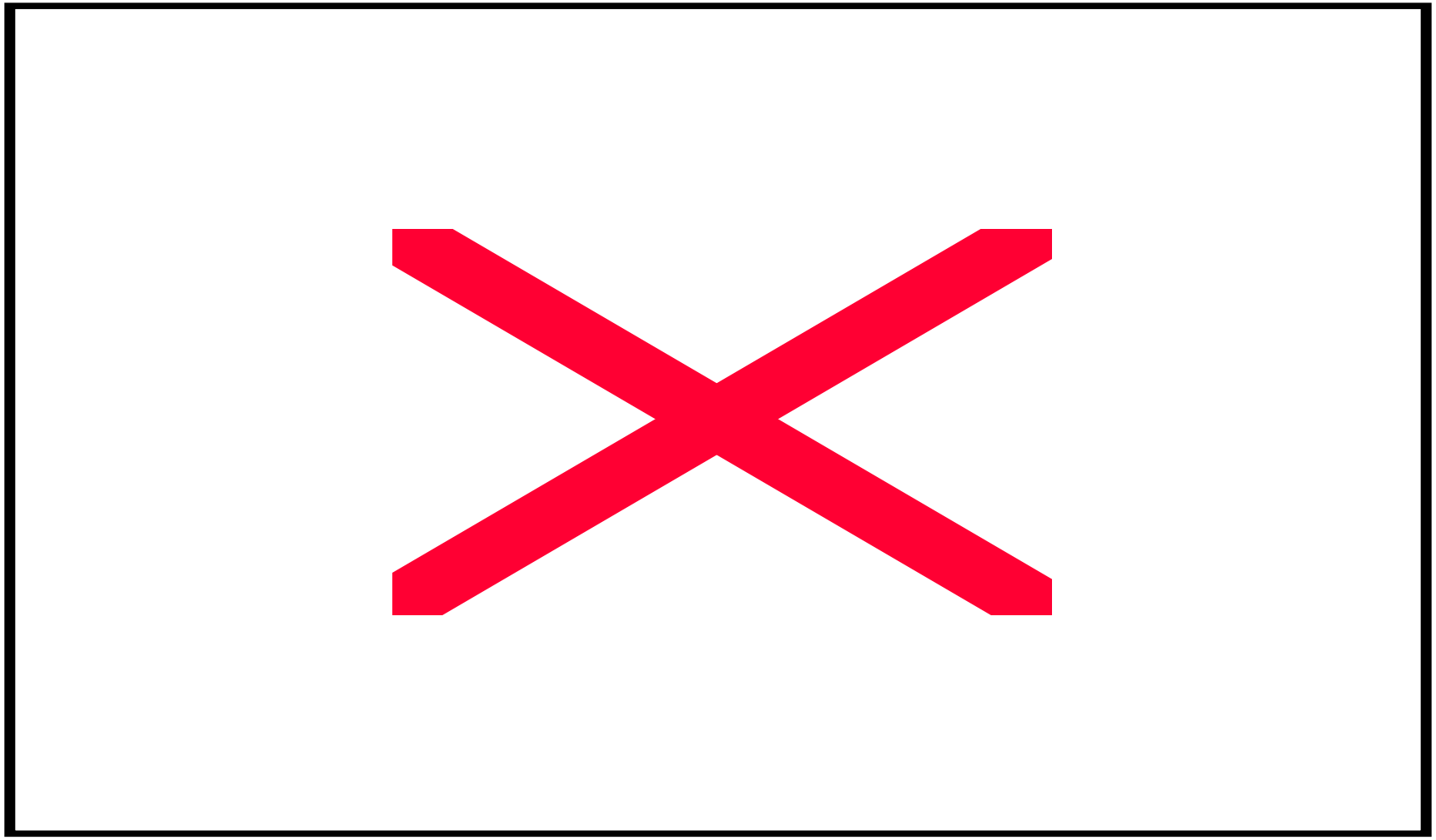
Table 7. Summary of Estimated Phosphorus Loads and Reductions for Point and Nonpoint Sources Within the Cascade Reservoir Watershed



* Contains management, natural and background loading.

[1] Contains management, natural and background loading.
[2] A 70% reduction (from 726 kg/yr to 218 kg/yr) has already been achieved.
[3] Reductions are driven by both water quality and public health concerns and will be accomplished on a service area basis as opposed to an individual basis.

Table 8. Summary of Estimated Subwatershed Based and Watershed Based Phosphorus Reductions for Point and Nonpoint Sources Within the Cascade Reservoir Watershed



[1] A 70% reduction (from 726 kg/yr to 218 kg/yr) has already been achieved.

[2] Reductions are driven by both water quality and public health concerns and will be accomplished on a service area basis as opposed to an individual basis.

Land Use Changes

Land Use Change Scenarios

The Cascade Reservoir Phase I and Phase II Watershed Management Plans and this Implementation Plan address loading issues and implementation strategies on a land-use basis. However, land-use distributions are not static. Data collected within the Cascade Reservoir watershed show diminishing agricultural and forestry land use and increasing urban/suburban land-use trends. It is acknowledged that changes in land use will continue to occur throughout the implementation process and into the future. The following discussion is therefore intended to address this potential and ensure that land-use changes will not result in non-attainment of the required load reductions. This discussion is not intended as a mechanism to address current loading. Three generalized scenarios have been considered in evaluating the potential impact of land use changes on implementation of the Cascade Reservoir Phase II TMDL. These scenarios have been outlined as follows:

- Move High Load to Low Load Situation
  - Example: Convert Developable Land to Conservation Easement
- Move Low Load to High Load Situation
  - Example: Convert Developable Land to Residential
- Transition/Construction Impacts
  - Example: Construction Erosion and Sedimentation

If pre-development and post-development phosphorus loadings can be quantified, three approaches may be considered with regard to the management of new development impacts. These approaches are outlined as follows:

- Apply BMPs to Achieve Reduction Goal
- Apply BMPs to Maintain Pre-Development Loads (No Net Increase)
- Compensate for Increased Load with Other Reductions

The following section presents a discussion of current development trends in the Cascade Reservoir watershed and the policy considerations associated with development.

New Development Policy

New development represents a unique aspect of loading and reduction considerations within the watershed as it commonly represents a change in land-use from within the existing nonpoint source categories. Currently, there are three types of new development in the Cascade Reservoir watershed that introduce changes in land use:

1. Division of Large Rural Tracts into Smaller Rural Tracts. These divisions result in tracts ranging from one or two acres, to forty acres in size. The most popular sizes are from five to twenty acres. The majority appear to be investment properties that remain undeveloped for many years. Others provide spacious sites for ranchettes where about one acre is developed with buildings, driveways, parking, and utilities. The remaining area is removed from agricultural production to remain idle as grassland or to support hobby livestock. In the near-term, this may result in improved runoff water quality. In the long-term however, many of these lands may move to a more intensive level of development.
2. Land use change by zoning process. Commercial, industrial, multi-family, and subdivisions generally require zoning approval through a public hearing process in most local jurisdictions. A formal land use change is subject to review of agencies, adjoining property owners, and the public. The application includes a site grading plan that demonstrates the use of best management practices to minimize sediment transport during construction and in the final development. This provides a strong link to water quality management by controlling erosion and sedimentation.
3. In-fill Development. The Valley County Building Department issues approximately 350 building permits each year. In 1999, 61 of those were for new residential homes. Excavations for foundations and utilities, and construction of impervious surfaces such as roofs, driveways, and parking areas increase stormwater runoff and the potential for sediment transport. Most parcels undergoing this type of development are located in urban/suburban areas. It is typical for these parcels to have been undeveloped for many years with limited runoff. Development of these parcels is frequently in areas where runoff is transported to surface waters.

The dominant trend in land-use change within the Cascade Reservoir watershed is the conversion of agriculture and forested land to urban/suburban development. The area of the watershed most vulnerable to this type of change is the valley floor and fringe areas along the foothills. Features such as view, topography, recreation potential, and access by public roads drives development decisions. Income from property sales supplements or replaces more limited income derived from agricultural land use.

It is recognized that in order to effectively meet phosphorus reductions throughout the watershed, all contributing sources must participate in the reduction effort. Limiting reductions to existing land uses alone will place an unfair burden for phosphorus reduction on established practices. This burden will increase over time with occurrence of land use changes within the watershed.

Primary responsibility for review and approval of new development rests with local authorities. Zoning within the watershed is administered by the Valley County Planning and Zoning Commission and the cities of McCall (city impact area), Donnelly, and Cascade. The decisions for the three city commissions are subject to the action of their respective city councils. The County decisions are subject to action by the Board of County Commissioners. Most County actions are only reviewed by the Board upon

appeal. Ordinances are adopted by the city councils and the County Board. The majority of the watershed area where land use can change from agriculture is administered by the County.

Efforts have been made to control the impact of construction on water quality. The City of McCall has adopted a stringent site grading ordinance. Valley County has adopted the "Handbook of Valley County Stormwater Best Management Practices" and the County Building Department is encouraging the use of the Handbook with the following stamp on site plans for building permits:

"SITE GRADING NOTE: Excavators are encouraged to use the "Handbook of Valley County Stormwater Best Management Practices" for site grading, foundation excavation, driveway construction, utility trenches, etc. For more information contact the County Engineer's office, 382-4251"

The County's Conditional Use Permit process requires a site grading plan and the applicant, or design engineer, is required to demonstrate that BMPs are utilized to mitigate erosion and sedimentation during construction. The site grading permit is subject to review by the County Engineer and the Valley Soil and Water Conservation District, and can be reviewed by interested agencies and the public during the formal review process. The Planning and Zoning Commission and the Board of Commissioners will use the input received in this process in preparing Conditions for Approval for new development proposals and will officially accept a plan as part of a Conditional Use Permit. This provides a link between water quality management considerations and the review and approval process for new development.

An assessment of projected water quality impacts (both positive and negative) incorporated within the existing process for review of proposed new developments, would allow an equitable and effective distribution of the required phosphorus reduction to all land uses. This incorporation of Phase II TMDL requirements, BMPs, mitigation, and reduction mechanisms as part of this review process will further assure the success of the Phase II TMDL and Implementation Plan at a local level.

On a state level, permit applications submitted to DEQ for new development within the watershed of an impaired water body will be evaluated as to potential water quality impacts, and will be reviewed with Phase II TMDL load and reduction allocations in mind.

Implementation Plan Schedule

A schedule for planned actions to implement the Cascade Reservoir Phase II TMDL is a key tool to organize and coordinate phosphorus reduction efforts, pursue funding support, and track accomplishments. However, a complicating factor in Cascade Reservoir watershed implementation planning is that a firm schedule for completion of the proposed implementation measures cannot be formulated without assurance of funding. Until funding sources are secured, an active program to identify and prioritize projects has been established to allow immediate application of funds as they become available. A nominal schedule has been developed based on a number of assumptions in order to allow the sequence of activities and the potential interface between actions to be considered.

Implementation Schedule

An example schedule for the Cascade Reservoir Phase II TMDL Implementation Plan has been developed for review and discussion. Figure 1 illustrates a sequence of activities extending from the Phase II TMDL, through the preparation of the Implementation Plan, and including the pursuit of outside funding and execution of phosphorus reduction BMPs/projects.

The schedule in Figure 1 illustrates the relationship between the planning activities and potential implementation actions to reduce phosphorus loadings. Project funding is key and a series of five funding cycles are shown to implement the external phosphorus reduction projects. Potential external funding sources of all types are grouped under the funding request for each of the five years to pay for all, or part, of nonpoint source projects from the three major nonpoint sources. Implementation of projects and BMPs is assumed to follow each annual funding cycle.

For the example schedule shown in Figure 1, it is assumed that these five rounds of funding provide adequate resources to construct all of the BMPs/projects needed to accomplish the targeted 37 percent reduction in external phosphorus loadings. This results in the first year of full implementation of planned projects extending beyond the year 2006.

Funding Programs

Implementation funding may vary with individual sources. Potential examples of funding sources include bonds, sewer districts, Local Improvements Districts, Block Grants, SIPs, State Revolving Funds, TEA 21 programs, CWA 319 Grants, EQUIP funding, CRP programs, special legislative grants/funding, and a myriad of other federal, state and local opportunities. The following discussion highlights a few of these funding programs to illustrate the program management activities and scheduling that may be

required. It is assumed for the sake of this example that external funding to support Phase II TMDL implementation can be secured from three sources; the Idaho state legislature, CWA Section 319 Grants, and the federal EQIP program. Figure 2 illustrates the main activities involved in pursuing funds for each of these pathways. Funding from the state legislature assumes a budget request formulated in the year 2000 for the January 2001 legislative session. Projects proposed for funding require a sponsor or may be submitted as part of the DEQ budget. It has been assumed that projects funded by the legislature have funds available to the state in July of the same year, with allocation to recipients for projects by September. This results in funds being available to implement BMPs/projects very late in the construction season. The schedule shown in Figure 2 illustrates extension of implementation activities through the following summer in order to allow for more favorable construction conditions.

The Boulder/Willow Creek 319 Grant is used to illustrate the funding cycle for this program in Figure 2. The grant application was prepared in December of 1998 for projects that will be implemented beginning in the summer of 2000. Budget resources are assumed to be available from EPA in March/April of 2000. This is followed by development of conservation plans and land owner contracts, and approval by the Valley Soil and Water Conservation District (VSWCD) Board. The 319 Grant program combines 60 percent cost share funds from EPA with a 40 percent land owner match. At least one project or practice from the conservation plan must be implemented in the first 12 months of the program. The conservation plan must be sustained for a minimum of 5 years and a maximum of 10 years for reimbursement. The VSWCD provides annual status reviews and maintains a tracking system for monitoring the program.

The Lake Fork Creek Priority Area EQIP project is used to illustrate the funding cycle for the federal Environmental Quality Incentive Program in Figure 2. The program application was prepared in June of 1999 with Natural Resources Conservation Service (NRCS) approval in September of 1999. Budget resources became available in January of 2000. This is followed by development of conservation plans and land owner contracts, and approval by the Valley Soil and Water Conservation District (VSWCD) Board. At least one cost share practice must be implemented in the first 12 months of the program. The conservation plan must be sustained for a minimum of 5 years and a maximum of 10 years for reimbursement. The VSWCD provides annual status reviews and maintains a tracking system for monitoring the program.

Implementation Schedule Considerations

While the example schedule in Figure 1 serves only as an illustration of a potential sequence of activities for implementing the Phase II TMDL, important observations can be made that may enhance the prospects for implementation of phosphorus reduction BMPs/projects. First, securing outside funding support is key. It appears that a multi-stage effort is necessary to plan, fund, and execute projects. Both the need to continuously seek outside funding support and the need for multiple project coordination

over an extended period of years, emphasize the need for on-going program management. Program management will be needed to sustain the administration of the overall Phase II TMDL, track progress, fund projects, and coordinate individual project implementation. Adequate consideration should be given to funding the on-going program management effort needed to implement the Phase II TMDL.

Full implementation of the targeted 37 percent reduction in external phosphorus loadings will not occur for a number of years. As discussed below, the timeline for expected improvements in Cascade Reservoir water quality were estimated to extend over a period of 5 to 20 years in the Phase II TMDL. It appears from the example implementation plan schedule that it will not be possible to gauge the full impact of planned reductions until after the target date set for the Cascade Reservoir Phase III Watershed Management Plan Progress Report in December 2003. More aggressive project funding would allow the planned phosphorus reduction projects to be implemented earlier. Conversely, project implementation will lag if project funding is delayed or unavailable.

Figure 1. Cascade Reservoir Phase II TMDL Implementation Plan Draft Schedule

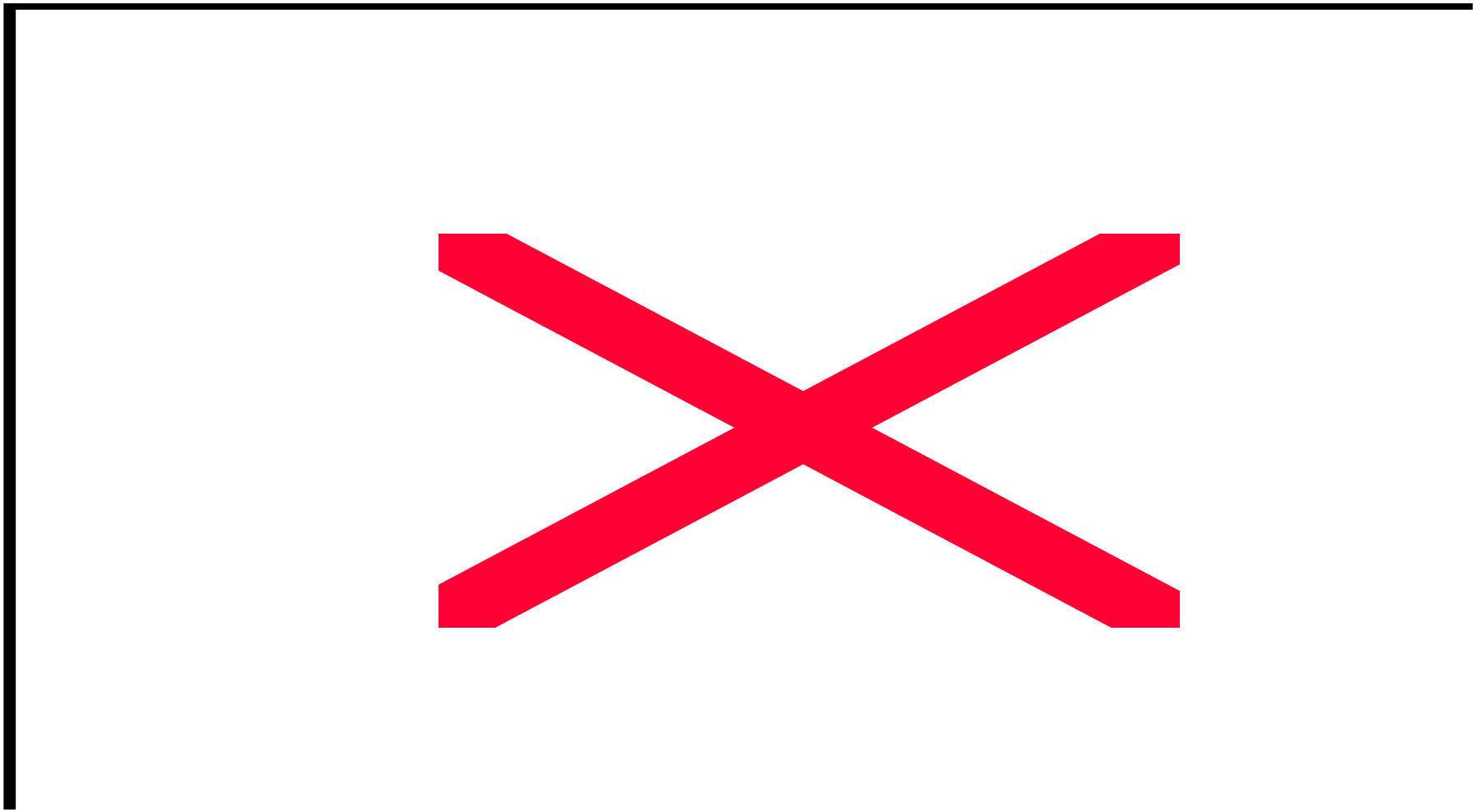
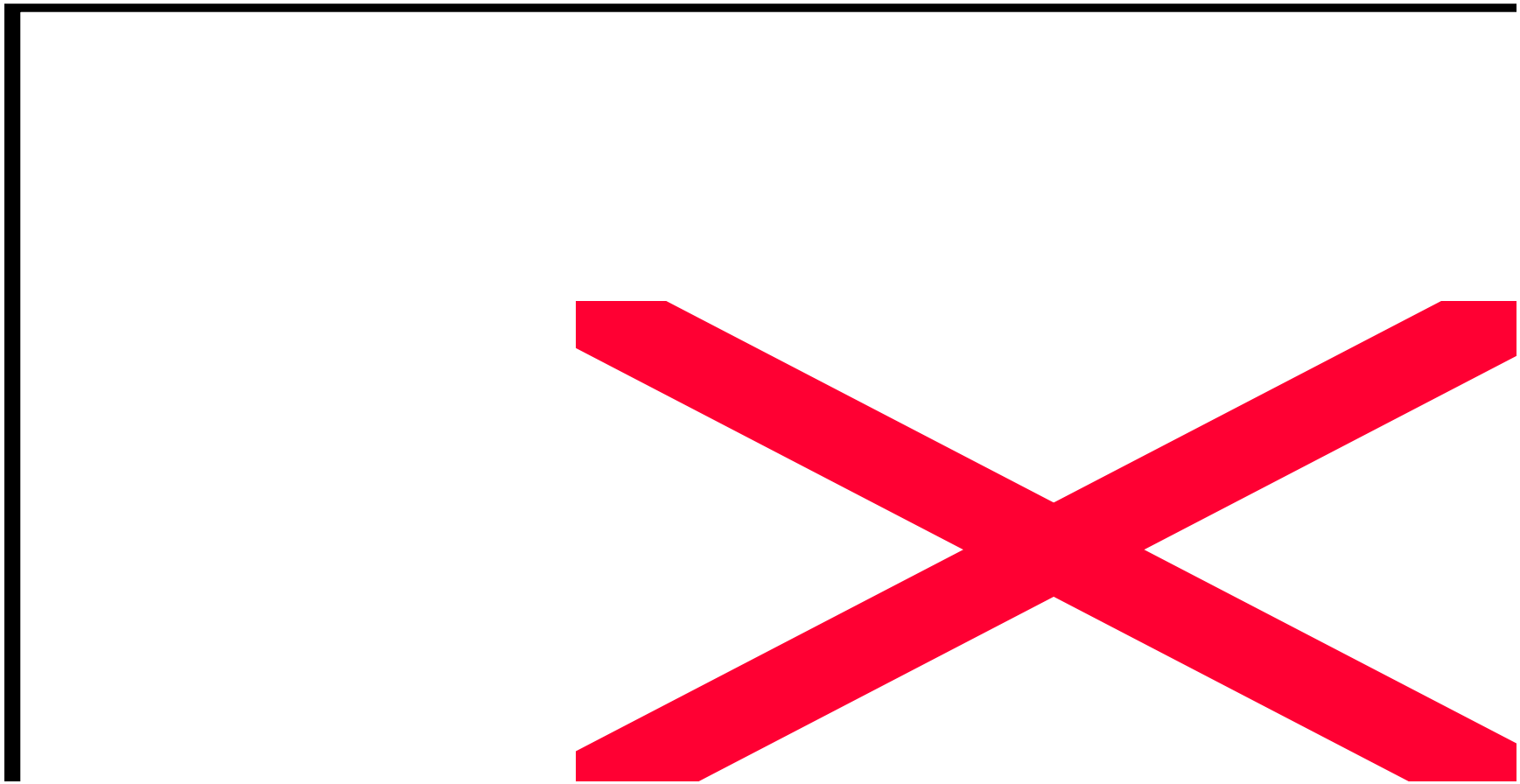


Figure 2. Example External Funding Cycles for State Funds, 319 Grants and the Environmental Quality Incentive Program (EQIP)



Milestones for Attaining Water Quality Standards

Water quality model simulations of Cascade Reservoir conducted in support of the Phase II TMDL indicate that a sustained 37 percent reduction in total external phosphorus loadings results in a continuing trend of water quality improvements over a 20 year period. While actual changes in water quality may vary considerably and individual years will be influenced to a large degree by weather conditions, the water quality model simulations provide a general reference to track expectations for changes in reservoir quality.

Figure 3 illustrates predicted improvements in Cascade Reservoir water quality resulting from a sustained 37 percent reduction in total external phosphorus. An initial period of rapid improvement is predicted for the first five years. A forecast of a more gradual trend of improvement follows for the next 15 years.

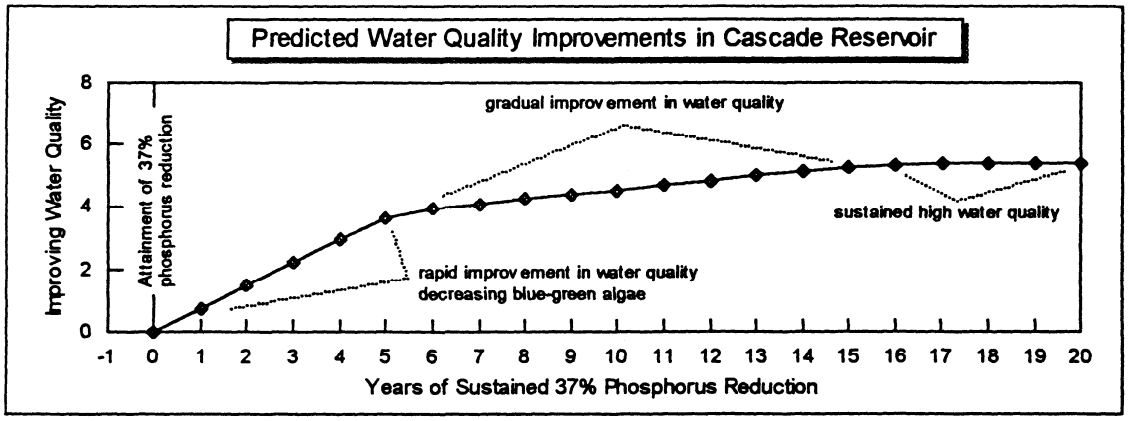


Figure 3. Water Quality Model Predicted Improvements in Cascade Reservoir

(Source: Cascade Reservoir Phase II Watershed Management Plan, Appendix C: Computer Modeling Summary)

This forecast of water quality improvement presumes climatic and weather conditions are near average. Cascade Reservoir water quality benefits from increased snowpack and precipitation. Conversely, adverse drought weather conditions would be expected to delay projected improvements.

Estimated Cost of Reductions

Point Source Costs

Point source reduction costs include the construction of the McCall J-Ditch pipeline project and the planned McCall seasonal effluent storage pond. The McCall J-Ditch effluent pipeline project is completed and costs are a matter of historical records. The McCall seasonal effluent storage pond is in the process of design and implementation. Capital costs are estimated to be on the order of $5 to $7 million. The total public funding devoted to the J-Ditch project is estimated to be between $8 and $10 million upon completion.

Nonpoint Source Costs

Capital and operation and maintenance costs for implementing the nonpoint source reduction measures planned by the source groups, where available, are presented in Table 9. The purpose of identifying these costs is to provide a basis for project budgeting. Cost entries in Table 9 are estimates based upon currently available information which will be updated with more precise information on actions taken in the year 2000 when the first annual report on implementation activities is prepared. These costs include both public and private financial contributions to project funding. In most cases the total estimated costs to achieve the reductions are drawn directly from the source-specific implementation plans.

Cost Estimation Assumptions

A common set of economic analysis assumptions is required for consistent consideration of phosphorus reduction efforts from each of the source groups. In terms of capital costs, all estimates should be formed under the same assumptions for the base date of the estimates for reference and future updates. The scope of the cost estimates should be consistent and include the same base assumptions for contents. When using historical costs as the basis of new estimates, it is important to consider whether reference information includes all applicable costs. For example, total project costs, as opposed to bare construction costs, include allowances for the following: construction contractor overhead and profit; mobilization/demobilization, engineering, legal, and administrative costs; provision for sales tax/public works utilities tax; and adequate contingencies.

Table 9. Summary of Estimated Costs for Implementation of Phosphorus Reduction Measures

Source	Capital Cost (Pending Funding) ($)[a]	Capital Cost (Funded) ($)[a]	Total Capital Cost ($)[a]	Operations and Maintenance ($/yr)[b,c,d,e]
McCall Wastewater Treatment Plant	7,000,000	2,996,000	9,996,000	38,000
Agriculture Tier 1	1,830,000	146,000	1,976,000	9,900
Agriculture Tier 2	6,222,000	4,874,382	11,096,000	55,500
Agriculture Tier 3	933,000	0	933,000	4,700
Forest Grazing	40,400	46,600	87,000	44,050
Forest Roads	598,988	1,201,012	1,800,000	131,454
Non-Subdivision Roads	1,419,598		1,420,000	71,000
Subdivision Roads	2,025,974		2,026,000	101,000
Urban Stormwater	393,013		393,013	7,900
Rural Residential Subdivision Stormwater	111,375		111,375	2,200
Septic System Upgrades[f]	8,043,000		8,043,000	14,000
Other Nonpoint Sources[g]				
Total	28,617,000	9,264,000	37,881,000	480,000

[a] Some project costs have been funded previously. Pending funding indicates new budget resources are required. Assumes estimated costs are based on a December 1999 Seattle Area Engineering News Record construction cost index (ENR-CCI) of 7,137.
[b] O&M costs for wastewater treatment at McCall and NLRWSD and SLRWSD are assumed to be $0.15 per 1000 gallons treated.
[c] O&M costs for Agricultural Tiers 1, 2, and 3 are based on an assumed 0.5% of capital costs/year.
[d] O&M costs for subdivision and nonsubdivision roads is assumed to be 5% of capital costs/year.
[e] O&M costs for urban and rural stormwater BMPs is assumed to be 2% of capital costs/year.
[f] Assumes 650 NLRWSD sewer connections at $6,450 each and 350 SLRWSD sewer connections at $11,000 each.
[g] Costs for other nonpoint sources including NFPR-unidentified sources, background-Big Payette Lake, background-Little Payette Lake, and other natural/background sources are not defined.

Consideration should be given to unified assumptions for the components of capital cost estimates. As an example, municipal utility capital improvement programs typically utilize standardized assumptions in estimating costs to provide consistency, a basis for comparisons, and ease in developing future updates. Cost indices, such as the Engineering News Record Construction Cost Index (ENR-CCI), are frequently used to establish a date reference and a basis for updates. For example, a December 1999 Seattle Area ENR-CCI value is 7,137. Providing an allowance for contingencies is a sound practice for project budgeting. Contingencies account for accuracy in estimating, unknowns at the time of estimating, and potential changes in the scope of work and actual field conditions. Typically, contingency allowances range from 10 to 20 percent of construction costs, depending upon the level of development of the cost estimates. For projects that require contracting with a constructor, allowances must also be made for mobilization and demobilization of work crews and general contractor overhead and profit. Typically, mobilization, surety bonds, and liability insurance costs range from 3 to 5 percent of the construction costs. General contractor overhead and profit generally ranges from 15 to 20 percent of construction costs. Project management, administration, design services, and legal services may all be required components of a program to undertake water quality improvements. Typically, these allied costs account for 25 to 35 percent of the total installed cost of capital projects. While all of these costs are not applicable to every project, this summary identifies important considerations for cost estimates.

Economic Analysis

The purpose of conducting economic analysis of project costs is to compare options and their effectiveness. Life cycle cost analysis allows projects of varying capital and operations costs to be compared. When combined with phosphorus removal effectiveness, project costs can be compared in terms of their economic benefit per unit of phosphorus removed. Additional cost information and assumptions are necessary for complete life cycle analysis. These include annual operations and maintenance cost estimates for projects and estimated effective lives for BMPs/projects.

Preliminary estimates of operation and maintenance costs were developed for projects and BMPs, as shown in Table 9. The annual costs for wastewater treatment and land application for the City of McCall and the annual cost for treating the wastewater at the North Lake and South Lake Recreational Water and Sewer Districts (NLRWSD and SLRWSD), is assumed to be $0.15 per 1,000 gallons treated per year. The annual operation and maintenance costs for Tiers 1, 2 and 3 agricultural BMP projects are assumed to be 0.5 percent of the capital project cost. The annual operation and maintenance cost for urban/suburban subdivision and non-subdivision roads is assumed to be 5 percent of capital costs. The annual operation and maintenance cost for urban and rural stormwater BMPs is assumed to be 2 percent of capital costs.

Table 10 combines capital and operations and maintenance costs from Table 9 with the phosphorus reduction values for the point and nonpoint sources from Table 7 and Table 8. Costs are shown by source with estimated reductions in mass units of phosphorus per year (kg/yr). Two approaches to using economic analysis to compare the cost effectiveness of phosphorus reduction measures are presented in Table 10. The first is a simple combination of capital cost divided by phosphorus reduction in kilograms per year. This results in a measure of the initial capital cost per rate of annual phosphorus reduction ($/kg/yr). This approach does not account for annual operations and maintenance costs, nor does it account for the continuing phosphorus reduction benefit that projects/BMPs provide in subsequent years over their useful lives.

The second approach to comparing cost effectiveness utilizes both capital and annual operations and maintenance costs in combination with phosphorus reduction. Inclusion of annual operating costs with assumptions about project life and duration of effectiveness allows the economic analysis to be extended to consider life cycle costs. In Table 10, capital and annual operations and maintenance costs are used to calculate equivalent annual costs using assumptions about useful project lives and the time value of money. An interest rate of 7 percent has been assumed and useful lives vary depending upon the nature of the BMPs and projects. Life cycle costs are divided by annual phosphorus reductions rates (kg/yr) to calculate a unit cost for removal. This results in a measure of the capital and operations and maintenance costs per unit of phosphorus reduction ($/kg).

Table 10 assumes a 20-year life for point source projects and sewer hookups for septic systems. Life cycles for nonpoint source measures have been estimated by the source work groups. Tier 1 agriculture projects are expected to have an average 15 year life. Tier 2 and 3 agriculture projects are expected to have an average 20 year life. Changes to grazing allotments on forested land are considered permanent; a 20 year life is used to calculate cost per kilogram reduced for forestry grazing improvements. Forestry roads are assumed to have a 15 year life. Subdivision road and non-subdivision road improvements are assumed to have a useful life of 20 years. Useful lives of urban and rural residential stormwater BMPs vary from 10 to 50 years. A 50 year useful life has been chosen for cost calculations based on the projected useful life of vegetated swales and filter strips.

Table 10. Economic Analysis and Comparison of Unit Costs for Phosphorus Reduction Measures

Source	Total Capital Cost ($)[a]	Operations and Maintenance ($/yr) [a]	Estimated P Reduction (kg/yr) [b]	Capital Cost per P Reduction Rate ($/kg/yr) [c]	Equivalent Annual Cost ($/yr) [d]	Cost per Kilogram ($/kg) [e]
McCall Wastewater Treatment Plant	9,996,000	38,000	3,947	2,500	982,000	250
Agriculture Tier 1	1,976,000	9,900	849	2,300	227,000	270
Agriculture Tier 2	11,096,000	55,500	2,512	4,400	1,103,000	440
Agriculture Tier 3	933,000	4,700	124	7,500	93,000	750
Forest Grazing	87,000	44,050	1,198	100	52,000	40
Forest Roads	1,800,000	131,454	1,454	1,200	329,000	230
Non-Subdivision Roads	1,420,000	71,000	324	4,400	205,000	630
Subdivision Roads	2,026,000	101,000	430	4,700	293,000	680
Urban Stormwater	393,013	7,900	445	900	36,000	80
Rural Residential Subdivision Stormwater	111,375	2,200	160	700	10,000	60
Septic System Upgrades	8,043,000	14,000	1,544	5,200	773,000	500
Other Nonpoint Sources[f]			2,134			
Total	37,881,000	480,000	15,121	2,900	4,089,000	270

[a] Capital and operations and maintenance costs from Table 9.
[b] Estimated phosphorus reduction values from Table 7.
[c] Calculated as follows: (Initial capital cost, $)/(Annual phosphorus reduction rate, kg/yr) = $/kg/yr.
[d] Calculated as follows: (Initial Capital Cost, $)*(Capital recovery factor [$Int*(1+Int)^n/(1+Int)^n-1$])+(Annual O&M cost, $/yr) = ($/yr). The factor Int is the annual interest rate (assumed to be 7 percent) and the factor n is the years of useful life.
[e] Calculated as follows: (Equivalent annual cost, $/yr)/(Annual phosphorus reduction rate, kg/yr) = $/kg.
[f] Costs for other nonpoint sources including NFPR-unidentified sources, background-Big Payette Lake, background-Little Payette Lake, and other natural/background sources are not yet defined.

Evaluation of Progress/Reporting

Annual reports from each source work group, detailing phosphorus reduction measures implemented, observed emplacement and operation efficiencies, and projected load reductions will be submitted to the appropriate TAC representative for inclusion in the Cascade Reservoir Implementation Plan database and tracking system.

Project Tracking System

The Phase II TMDL Implementation Plan tracking system serves as a master summary of all projects and BMPs constructed for the purpose of reducing the phosphorus load to the Cascade Reservoir. The system will be used as a management tool to assess phosphorus load reduction, to analyze cost effectiveness, and to assess performance of each BMP either individually or as a whole. Components of the tracking system include the following project characteristics:

- Project/BMP identification and description
  - Date scheduled
  - Date completed
  - Date inspected for proper implementation
    Inspector
- Location and mapping
  - Subwatershed
  - Source
- Project priority and substantiation
- Quantify estimated phosphorus control effectiveness
- Identify collateral benefits (in-stream flows, temperature, fisheries, aesthetics, flooding)
- Identify estimated costs (capital, operation and maintenance)
- Funding description
  - Source (private/public/joint, etc.)
  - Type/schedule (one time vs. ongoing, cost-share, etc)

The tracking system will provide a database summary of all projects and BMPs in the Cascade Reservoir watershed. Project information is entered into the database using a standardized form that will automatically tabulate the data. Individual projects, subwatersheds, and the entire Cascade Reservoir watershed will be assessed for phosphorus load reductions and cost effectiveness from the information available in the database. The tracking system will be used to support the preparation of annual reports and to document projects completed. Since the database also tracks projects yet to be completed, it will provide an aid to developing a funding strategy and project construction schedule. Finally, the database will be linked to a geographic information

system (GIS) mapping system to locate each project within the Cascade Reservoir watershed.

The tracking system is built using a Microsoft Access interface. This is a readily accessible program with a user-friendly interface. Microsoft Access can also be linked to ArcView to provide GIS functionality to create maps and locate projects within the watershed.

Microsoft Access allows data to be entered into the database using a standardized form creating a quality control/quality assurance feature. Each project will be identified with a unique project number, as well as a project description and location. Phosphorus load reduction data, and sediment data where available, will be entered into the database, along with the cost of the project. This information will be used to locate each project within the watershed, summarize the phosphorus load reduction effort, analyze cost effectiveness of the projects, and aid in determining project schedules. Microsoft Access also allows for preparation of data queries and project summary reports. Project reports can be prepared in a standardized format.

A project summary report lists all of the projects with their associated phosphorus load reduction values. This report provides the project number, project name, a brief description and the estimated phosphorus load reduction. A total phosphorus load reduction is included at the end of the report to track progress in pursuit of the Phase II TMDL goal. The report is intended for use as a summary of all the projects and the load reduction in the watershed.

Projects can be sorted and queried by source group and subwatershed. This allows for analysis of the Phase II TMDL reduction goals of the individual source groups and subwatersheds.

A cost effectiveness report lists the projects with their capital cost and unit cost per mass unit ($/kg) of phosphorus reduction. This report provides the project number, name, capital cost, and cost per unit of phosphorus load reduction. A total cost will be calculated at the end of the report. Two versions of this report are produced. One will utilize estimated project costs from planning. The second version tracks actual project costs following project completion.

The project profile report is designed to provide a one-page summary of the database information available for an individual project. Project name, number, location, description, capital cost, date of implementation, ancillary benefits and a photograph are included in the project profile report. Each project will be viewed individually in order to document and analyze each performance.

The project schedule report is intended to provide timing information for planning implementation of projects and BMPs. Each project will be listed along with the projected and actual date of implementation.

The tracking system will be linked with a simple Cascade Reservoir watershed map to illustrate project locations. Initially, a GIS point coverage was created to locate projects within the watershed with a project number callout. Boise Cascade Corporation's GIS coverages were used to provide a base map of the area, which shows the watershed and a limited number of reference features such as roadways, cities, and waterways. Each project was shown with a dot and identified with the project number. The mapping was linked manually to the tracking system using the project number.

Annual Report

Annual reports detailing phosphorus reduction measures implemented, observed emplacement and operation efficiencies, and projected load reductions will be submitted to the appropriate TAC representative for inclusion in the Cascade Reservoir Implementation Database. The current schedule calls for preparation and submission of annual reports by November 30 of each year. This may change with refinement of the reporting process and scheduling of the other nonpoint source group annual reports.

The tracking system will be used to support the preparation of annual reports and to document projects completed. Since the database also tracks projects yet to be completed, it will provide an aid to developing a funding strategy and project construction schedule.

Monitoring

The DEQ has continuously monitored the water quality in the Cascade Reservoir watershed since 1993. The monitoring plan document outlines a proposed coordinated monitoring plan for the implementation of a Phase II TMDL allocation to improve reservoir water quality and the quality of runoff from contributing watersheds.

Implementation plan monitoring has two major components; watershed monitoring which includes both in-stream subwatershed monitoring and in-reservoir monitoring, and BMP monitoring. DEQ has primary responsibility for the former, while designated management agencies have primary responsibility for the latter. Watershed monitoring measures the success of the implementation measures in achieving Phase II TMDL goals. BMP monitoring measures the success of individual phosphorus reduction projects. Monitoring of Cascade Reservoir has six objectives:

- Evaluation of watershed nutrient sources, baseline conditions and reservoir loading.
- Evaluate trends in water quality data.

- Establish phosphorus storage and recycling capacity in Cascade Reservoir.
- Evaluate the effectiveness of constructed wetlands and detention ponds in reducing phosphorus loading to the reservoir and/or tributaries.
- Increase the flow and pollutant load information during the peak runoff season in order to more accurately determine phosphorus loading to the reservoir.
- Increase temperature information on tributaries.

Currently, an annual report is written to document changes in load and concentration in Cascade Reservoir.

Subwatershed Monitoring

Success in reducing the current annual load of total phosphorus will be measured by comparing individual subwatershed allocations with the measured contributions monitored at or near the mouth of major tributaries. The current monitoring of the nine inflow stations is designed to quantify nutrient contributions from each of the nine subwatersheds that drain into Cascade Reservoir. Each of these stations is monitored monthly. However, during snowmelt periods, which causes high flows and an increase in phosphorus loading to the Cascade Reservoir, the monitoring stations are sampled weekly. Flow, conductivity, pH, temperature, and dissolved oxygen measurements are taken and water samples are collected for analysis.

Reservoir Response Monitoring

Reservoir response monitoring measures the effectiveness of the Phase II TMDL and implementation measures. In-reservoir monitoring is scheduled to occur monthly during the ice-free season and includes physical, chemical and microbiological parameters. The four monitoring stations in the reservoir establish baseline conditions, phosphorus storage, and recycling capacity information for the reservoir. DEQ monitoring is expected to continue throughout the implementation process (through 2003 with extension schedule to be determined at that time), as outlined in the Phase II TMDL, and will provide a comprehensive assessment of changes in phosphorus and suspended sediment loading within the watershed.

BMP/Project Effectiveness Monitoring

Site or BMP-specific monitoring may be included as part of specific treatment projects if determined appropriate and justified, and will be the responsibility of the designated project manager or grant recipient. The objective of an individual project monitoring plan is to verify that BMPs are properly installed, being maintained and working as designed. Monitoring for phosphorus reductions at individual projects will consist of spot checks, annual reviews and evaluation of advancement toward reduction goals. Evaluation of advancement toward reduction goals will be accomplished using the project tracking system and annual reports.

Individual entities and source groups constructing BMP projects should include budget allowances for a monitoring program (qualitative and/or quantitative) for the project site. Those entities will be responsible for collection of data and reporting monitoring results to the Cascade Satellite Office. This data will be used to evaluate the effectiveness of the BMP project. Results will be used to recommend or discourage similar projects in the future and to identify specific subwatershed, or reservoir, monitoring information that indicate the implementation plan is not achieving expected results.

Reasonable Assurance

All identified point sources within the Cascade Reservoir watershed are permitted facilities administered by the EPA. These facilities are located within the City of McCall. Wasteload (WLAs) reductions have been incorporated into point source NPDES permits. However, the load reduction (WLAs and LAs) needed to achieve desired water quality and restore beneficial uses in the reservoir will not be achieved in its entirety by upgrades of the point sources.

For watersheds that have a combination of point and nonpoint sources, where pollution reduction goals can only be achieved by including some nonpoint source reduction, a reasonable assurance that reductions will be met must be incorporated into the Phase II TMDL (EPA, 1991). The load reductions for the Phase II TMDL rely on nonpoint source reductions to meet the load allocations (LAs) to achieve desired water quality and to restore designated beneficial uses.

Monitoring and the 'Feedback Loop'

Monitoring will be conducted to ensure that nonpoint source reduction mechanisms are operating effectively, and to give some quantitative indication of the reduction efficiency for in-place BMPs. The monitoring proposed for this plan includes both implementation monitoring and water quality monitoring. Implementation monitoring consists of a variety of methods such as spot checks, periodic project reviews and photographic documentation to demonstrate that phosphorus reduction measures have been properly installed, are being properly maintained and are performing as designed. Implementation monitoring methods have been summarized in the sections describing implementation measures and are described in more detail in the appropriate appendices.

Generally, water quality monitoring will not be carried out on a project-specific basis but rather as a suite of indicator analyses monitored at the outflow of major tributaries within the watershed. For example, a decrease in total phosphorus over time as monitored at the outflow of Mud Creek indicates that BMPs emplaced within this subwatershed were reducing total phosphorus levels within the tributary water column. This data will be used, in conjunction with flow measurements, to evaluate the overall decrease in total phosphorus mass being contributed to the reservoir by the subwatershed. Concurrent monitoring of reservoir water quality will be undertaken to determine the direct effects of the monitored subwatershed concentration trends on reservoir water quality.

If in-stream monitoring indicates an increasing total phosphorus concentration trend (not directly attributable to environmental conditions) or a violation of standards despite use of approved BMPs or knowledgeable and reasonable efforts, then BMPs for the nonpoint source activity must be modified by the appropriate agency to ensure protection of beneficial uses (IDAPA Section 16.01.02.350.02.b.ii). This process is known as the

"feedback loop" in which BMPs or other efforts are periodically monitored and modified if necessary to ensure protection of beneficial uses. With continued instream monitoring, Phase II TMDL implementation will initiate the feedback loop process and will evaluate the success of BMP implementation and its effectiveness in controlling nonpoint source pollution.

State Programs and Authorities

Under Section 319 of the CWA, each state is required to develop and submit a nonpoint source management plan. Idaho's Nonpoint Source Management Program (Bauer, 1989) was submitted and approved by the EPA. The nonpoint source management program describes many of the voluntary and regulatory approaches the state will take to abate nonpoint pollution sources. Since the development of the Nonpoint Source Management Program in 1989, revisions of the water quality standards have occurred. Many of these revisions have adopted provisions for public involvement, such as the formation of Basin Advisory Group (BAGs) and Watershed Advisory Groups (WAGs) (IDAPA 16.01.02052). The WAGs are established in high priority watersheds to assist DEQ and other state agencies in developing TMDLs, Watershed Management Plans and Implementation Plans for those segments.

The State of Idaho water quality standards refer to other programs whose mission is to control nonpoint pollution sources. Some of these programs and responsible agencies are listed in Table 11.

The State of Idaho uses a voluntary approach to control agricultural nonpoint sources. However, regulatory authority can be found in the state water quality standards (IDAPA 16.01.02350.01 through 16.01.02350.03). IDAPA 16.01.02054.07 refers to the Idaho Agricultural Pollution Abatement Plan (IAPAP) (IDHW, SCC, EPA; 1993) which provides direction to the agricultural community for approved BMPs. The IAPAP outlines responsible agencies or elected groups (SCDs) that will take the lead if nonpoint pollution problems need addressing. For agricultural activity it assigns the local soil conservation districts to assist the landowner/operator to develop and implement BMPs to abate nonpoint pollution associated with the land use. If a voluntary approach does not succeed in abating the pollutant problem, the state may provide injunctive relief for those situations determined to be an imminent and substantial danger to public health or environment (IDAPA 16.01.02350.02 (a)).

If a nonpoint pollutant(s) is determined to be impacting beneficial uses and the activity already has in-place referenced BMPs, or knowledgeable and reasonable practices, the state may request the BMPs be evaluated and/or modified to determine appropriate actions. If evaluations and/or modifications do not occur, injunctive relief may be requested (IDAPA 16.01.02350.2, ii (1)).

Table 11. State of Idaho Regulatory Authority for Nonpoint Pollution Sources

Citation	IDAPA Citation	Responsible Agency
Rules governing Idaho forest practice	16.01.02350.03(a)	Idaho Department of Lands
Rules governing solid waste management	16.01.02350.03(b)	Idaho Department of Health and Welfare
Rules governing subsurface and individual sewage disposal systems	16.01.02350.03(c)	Idaho Department of Health and Welfare
Rules and standards for stream channel alteration	16.01.02350.03(d)	Idaho Department of Water Resources
Rules governing exploration and surface mining operations in Idaho	16.01.02350.03(e)	Idaho Department of Lands
Rules governing placer and dredge mining in Idaho	16.01.02350.03(f)	Idaho Department of Lands
Rules governing dairy waste	16.01.02350.03(g) or IDAPA 02.04.14	Idaho Department of Agriculture

A voluntary approach is expected to be able to achieve the nonpoint source reduction goals. Strong public involvement coupled with the eagerness of the agricultural community demonstrates a willingness to implement BMPs and protect water quality. In the past, cost-share projects have provided the agricultural community technical assistance, information and education (I & E), and the cost share incentives to implement BMPs. The continued funding of these projects will be critical for the load allocations to be achieved in the Cascade Reservoir watershed.

Reasonable Assurance for Forestry BMP Implementation

The major forest landowners and land managers in the watershed have been working together throughout development of the Phase II TMDL and this Implementation Plan. All the major forest land managers have committed to achieving the reduction goals on forested lands. As a reflection of this commitment, the forest landowners have already completed several projects towards attaining this goal and have several more projects in the planning stages. This commitment on the part of the major forest land managers ensures that the reduction goals will be met for forested lands. All forest landowners are committed to continuing to work with DEQ and the Cascade Reservoir committees to ensure success of the program.

In addition to this commitment, various federal and state requirements and regulations will ensure that the forest landowners continue to maintain and improve road systems and riparian management. Forestry is one of the few regulated land uses in the watershed.

All owners will continue to abide by the rules and regulations of the State under the Forest Practices Act that require monitoring of BMP effectiveness and update of BMPs when they are found to be inadequate.

Additionally, the Forest Service will continue to follow land and resource management plans to implement activities. There is currently a Forest Plan Revision underway that is expected to be completed in December 2000. Activities include: timber harvest, road management, livestock grazing, prescribed fire, watershed improvements, fish habitat improvements, recreation management, and others. Sources of sediment/phosphorus will be identified and treatments implemented concurrent with activities. Activity plans are finalized and implemented as funds become available. National Environmental Protection Act and Endangered Species Act analyses will be required prior to implementation. Projects are scheduled based on funding and priorities on each forest. Partnership and cooperative efforts will be developed on a project-by-project basis.

For federal lands, funding for projects will rely upon fees taken in on timber sales and/or special federal allocations to address water quality problems. Funding sources include: collection agreements, soil and water improvements, road maintenance, ecosystem management, Capital Investment Project (CIP), 5 percent funds, and Knutsen-Vanderburg (K-V) funds, and other grants (CWA Section 319, National Forest Foundation, etc). Future direction from the Natural Resource Agenda, and Clean Water Action Plan may also provide future sources of funding.

Idaho Department of Lands relies largely on funds received from timber sales. Boise Cascade also has limited funds available to maintain and improve roads.

Reasonable Assurance for Agricultural BMP Implementation

BMP implementation for agriculture is achieved through voluntary incentive-based programs. Historically, cost-share incentives have been available to producers from state and federal conservation programs. The state incentive program was the SAWQP program. This program was established to assist agricultural producers in subwatersheds where critical acres are identified as contributing to a defined problem associated with a decline in water quality. In the Cascade Reservoir watershed, the Boulder/Willow and Mud Creek subwatersheds have a SAWQP plan. Contracts were developed and work has proceeded on these contracts through the Valley Soil and Water Conservation District (VSWCD). The SAWQP program has been historically funded through the Idaho Pollution Control Account. That fund was projected to deplete financial resources in 1999. All funds from this account have been allocated and the ability to write new contracts has been frozen. A SAWQP replacement program administered by the Idaho Soil Conservation Commission is expected to be in place in the near future, and will act as a funding source to projects similar to those funded by the original SAWQP program.

As well, the Lake Fork subwatershed has been designated as a high priority funding area under the EQIP program.

A new statewide cost-share program was approved and funded by the Idaho Legislature for the state fiscal year 2000. Funds for this program will become available in July of 2000. At the time this plan is being written, there were no funds or projects under this program targeted to the Cascade Reservoir watershed.

Federal programs have been available to landowners or producers for the implementation of BMPs or practices that will have a positive impact on the land and water quality. These programs historically include the Conservation Reserve Program (CRP), as well as Habitat Improvement Program (HIP), Wildlife Habitat Incentive Program (WHIP), Wetland Reserve Program (WRP), and the most recent program, EQIP Program. Federal programs are developed outside of the State of Idaho. Availability of funds, longevity, and rules of the programs are not subject to local management. Federal cost-share programs are expected to continue to be available in the future to assist meeting the requirements of the Phase II TMDL.

Reasonable Assurance for Urban/Suburban BMP Implementation

Successful implementation of recommended BMPs and management practices to reduce phosphorus loading within the urban/suburban arena will require the availability of cost share funding, loans, grants, or other sources of funding. Full-scale implementation cannot be expected to occur prior to the identification of such funding sources, and is expected to proceed on an intermittent basis, as funding becomes available. The adoption of a county-wide erosion and sediment control ordinance and implementation of specific programs recommended for the municipalities depends on action by the Valley County Commission and elected city officials.

Implementation Plan Revision

The Phase II TMDL included a plan for tracking progress in attaining water quality standards and if necessary, revising the Implementation Plan. A Cascade Reservoir Cascade Reservoir Phase III Watershed Management Plan Progress Report will be prepared following the adoption of the Implementation Plan and is targeted for completion in December of the year 2003. The Cascade Reservoir Phase III Watershed Management Plan Progress Report will utilize monitoring data to evaluate progress in attaining water quality standards in the reservoir and restoration of beneficial uses. If goals are being reached, or if trend analysis shows that implementation activities are resulting in benefits that indicate that water quality objectives will be met within a reasonable time, the Implementation Plan will not be revised. If analysis, or other information indicates that water quality goals will not be met, the Implementation Plan will be revised to include new objectives and a new strategy for implementation actions.

The following conditions could indicate a need to revise the Cascade Reservoir Implementation Plan:

- Monitoring data indicate water quality standards will not be attained by continued execution of the Implementation Plan.
- Actual effectiveness and efficiency of phosphorus reduction BMPs/projects falls short of or exceeds projections used in the Implementation Plan.
- Phosphorus reduction BMPs/projects are not executed according to the Implementation Plan due to lack of funding or other factors.
- Cascade Reservoir operational changes alter the minimum storage pool volume, or the timing of water releases, such that the relationship between external phosphorus loadings and in-reservoir phosphorus and chlorophyll a concentrations is changed.
- Monitoring data indicate that natural background loadings of phosphorus differ from historical data and revisions to reduction targets for manageable loadings are required.

A sustained effort in reduction of external phosphorus loadings will be needed to improve water quality in Cascade Reservoir. Natural weather conditions may affect the rate of progress in meeting the Phase II TMDL objectives for water quality improvement. Increased snowpack and precipitation is expected to benefit short-term water quality condition. Extended low water years are expected to delay beneficial improvements in water quality.

Other Options for Restoration of Water Quality

A number of management techniques for improving Cascade Reservoir water quality were considered in the development of the Phase II TMDL. These options included

chemical sealing of reservoir sediments, dredging of the trashrack channel to Cascade Dam, increasing the spillway discharge over the dam, aeration of the reservoir, modified reservoir operations, and external nutrient loading reduction. Each of these options was explored using a computer-based water quality simulation model developed for Cascade Reservoir. A brief summary of the conclusions of these investigations is presented in the following discussion.

Water quality modeling indicated that only two options provided the potential for long-term improvements in Cascade Reservoir water quality. These options were changes in reservoir management and reduction of external phosphorus loadings to the reservoir. Consequently, the focus of the Implementation Plan is on phosphorus loading reduction, with a stated operational objective of maintenance of a minimum pool of 300,000 acre-feet and the current split-release schedule for salmon flow augmentation. Other options for restoration of Cascade Reservoir were determined to have limited potential for water quality improvement for a variety of reasons.

Chemical sealing of the reservoir bottom sediments with alum to prevent the release of phosphorus under anoxic conditions was investigated. This option was viewed as expensive for application to such a large reservoir and would require repeated chemical applications if external phosphorus loadings to the reservoir were not reduced. Additionally, application of this treatment option has never been undertaken on a water body the size of Cascade Reservoir. All successful applications have been accomplished on water bodies of much smaller size. Because of this, the probability of success in the case of Cascade Reservoir is unknown.

Model simulation of a lower reservoir minimum pool indicated a negative effect on both water quality and fish habitat. A higher minimum pool typically increased the volume of water suitable for fish habitat. In 1982, IDFG recommended a 300,000 acre-foot total minimum pool based on a model they developed to predict the risk of winter fish kill at different minimum pools. The 300,000 acre-foot total minimum pool was administratively established by USBR in 1985.

Public Information and Education

Public information and education efforts are an important part of ensuring full and timely implementation of the measures proposed in this plan. Information and education will generally take two forms: general information about the plan directed to all residents and interests in the watershed and source-specific information and education efforts targeted to sources who may be involved in implementing phosphorus reduction measures. General information and education measures will include a public meeting sponsored by the CRCC to explain the draft plan, an opportunity for public review and comment, and distribution of the final plan to interested parties. HDR Engineering, Inc., under contract to DEQ, will also prepare and distribute a pamphlet describing the plan to up to 2000 interested parties. Ongoing information about implementation progress will be provided at CRCC and TAC meetings, which are open to the public, and on the Cascade Reservoir Implementation Web site (www.crews-cascade.org).

Forestry Information and Education Efforts

Load reduction information, BMP locations, and performance/efficacy values obtained during the course of implementation will be available to the public through a variety of public forums including reports to the CRCC, TAC, Implementation Plan Source Groups and other organizations and agencies. The information will also potentially be available to the public through the Cascade Reservoir Implementation Web site, public tours, implementation efforts brochures published as part of the Cascade Reservoir Implementation Plan, and included in the Cascade Reservoir Watershed Cascade Reservoir Phase III Management Plan Progress Report which will be completed in 2003.

Agriculture Information and Education Efforts

Valley Soil and Water Conservation District has been involved in various efforts to increase the knowledge and awareness of conservation practices for agricultural landowners. This has been advanced with methods such as with newsletters, workshops, articles and conservation planning.

Newsletters are mailed out to producers, landowners and interested residents of the district. These newsletters are produced at the District and provide general information about conservation practices as well as current events occurring at the district. Workshops that are held annually cover agriculture and other natural resource topics of special interest in the District. These workshops have been well attended by the general public. The District has also provided local media with articles about issues of interest to local agricultural land owners. Inserts from the local paper have been funded by and produced by the District. Subjects such as riparian management have been covered by this method. Education also occurs on a personal level when district planners visit landowners and producers to develop conservation plans.

Urban/Suburban Information and Education Efforts

Load reduction information, BMP emplacement mechanisms and performance/efficacy values obtained during the course of implementation will be available to the public through a variety of public forums including reports to the CRCC, TAC, Implementation Plan Source Groups and other organizations and agencies. The information will also potentially be available to the public through the Cascade Reservoir Implementation Web site, public tours, implementation efforts brochures published as part of the Cascade Reservoir Implementation Plan, and included in the Cascade Reservoir Phase III Watershed Management Plan Progress Report which will be completed in 2003.

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APPENDIX A

Cascade Reservoir Watershed Forestry Source Implementation Plan

(This document is bound separately)

APPENDIX B

Cascade Reservoir Watershed Agricultural Source Implementation Plan

(This document is bound separately)

APPENDIX C

Cascade Reservoir Watershed Urban/Suburban Source Implementation Plan

(This document is bound separately)